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EDITORIAL.

Roadside Trees in Malaya.

It would be a safe generalization to state that the question of planting roadside trees has in the past received too little attention in this country. The contributory causes of this are numerous, but perhaps the most important has been the realization that a large-scale planting programme entails a relatively heavy expenditure. However this may be, the last few years have seen an increasing interest in the beautification of Malaya's towns and villages, particularly on the part of the various Municipalities and Sanitary Boards, and to those who are professionally interested in this connexion, or who are fortunate in the possession of large private gardens suitable for the planting of trees, an article in this issue will be of interest and value.

The author first discusses the numerous factors to be considered in selecting ornamental trees or palms to suit various roadside situations, for limitations in the matter of available space restrict the choice of planting material to a marked extent. He then proceeds to a more detailed discussion of those trees and palms which his long experience has shown to be most suitable under local conditions, and describes the methods of propagating and planting these, while his concluding section on maintenance covers the general questions of staking, pruning, manuring, and protection from pests and disease. In conclusion, it might perhaps be remarked that most of the planting material described is usually available on application to the Department of Agriculture.

Tea Regulation.

Sanction has recently been given for the extension by a further 10,000 acres of the area planted with tea in Malaya. A short article in this number gives a brief account of the negotiations which led to this result and sets forth the conditions to be fulfilled by applicants for tea planting licences.

The Threshing Qualities of Padi.

Different varieties of padi vary greatly in respect of the ease with which they may be threshed. This has a practical significance in that most local padi is threshed by hand and the padi cultivator thus tends to favour those varieties which do not entail undue

exertion in this operation. We publish in this number a short article describing a preliminary attempt to measure this threshing character of the more important Kedah varieties; the mechanical device described can in addition be used for estimating the shattering character of padi, *i.e.* its tendency to loss of grain during the ordinary operations of harvesting.

An Out-of-Season Padi Trial.

An article in this number describes an attempt to ascertain whether, in a locality on the Perak River, a satisfactory crop of padi could be produced between the months of January and July instead of during the normal season July to March.

The locality in question had previously depended solely on rainfall for the growth of the crop, no irrigation by gravitation being possible. A scheme had been designed to provide irrigation by pumping from the Perak River and it was obvious that a considerable saving in respect of capital expenditure and maintenance charges would be made if it could be arranged that the padi season for one half the area should be from July to March, and for the other half January to July. Rainfall graphs indicated that approximately the same total rainfall might be expected to fall in each of these two periods, though the incidence differed. The scheme as proposed, however, provided for adequate irrigation to each half of the area in order that the crop should not suffer during the comparatively dry periods within each of the projected seasons.

It is axiomatic under temperate conditions that an annual plant requires to be grown in its proper season, and that temperature and the length of day are the major features involved. It is not so obvious that the question of season may also have to be taken into account in the equatorial regions, where these factors are not subject to the marked variations encountered in temperate countries, especially when other growth requirements, such as adequate moisture, can be provided. Even a slight acquaintance with the problems connected with padi cultivation, however, gives rise to the conviction that the rice plant is particularly sensitive to environment in many respects, and before advocating that certain of the padi cultivators in the particular area should change their usual season it was deemed necessary to determine by experiment if the change was in fact an economic possibility.

The experiment described proved that in the locality concerned a satisfactory crop of padi cannot be expected if grown in the January to July season. The reason for this lies outside the design of the experiment, but the latter gave rise to strong indications that the influence of season may be more closely related to the incidence of pest than to a direct effect on the plant itself. These indications receive some confirmation from additional experiments conducted by the Entomological Division of this Department.

Original Articles.

PLANTING OF ROADSIDE TREES IN MALAYA

BY

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Introductory.

In the lay-out of modern towns and villages methods of planning allow for wider streets and approach roads, also open spaces, all of which can be made more attractive by the planting of trees.

The selection, method of planting and subsequent treatment of roadside trees have accordingly become matters of considerable importance during the past few years and the following information may prove of value to those who are connected with these undertakings.

Selection of Trees.

In selecting suitable trees for shading streets and roadsides a large number of conditions require consideration. The essential qualities of a good shade tree are as follows:—

(i) It should be evergreen or, if deciduous, it should produce new foliage soon after losing the old leaves.

(ii) A good spreading head of strong branches, with a clean upright stem for at least 12 feet from the ground.

(iii) A somewhat restricted root system so as not to break up drains and footpaths.

(iv) It should be a fairly fast grower.

(v) The leaves should be as small as possible and preferably have the habit of closing up at night.

Trees which produce much litter, or those with large leaves and heavy fruits, should be rejected, while many trees of rapid growth produce either soft or brittle wood and are usually short-lived.

In narrow streets it is not practicable to plant trees with spreading branches, but there are several evergreen kinds with an upright cylindrical or pyramidical form which make them specially suited for confined situations.

Several shade trees, especially leguminous ones, *e.g.* rain tree, have the habit of closing up their foliage at night or in dull cloudy weather, thus allowing a free circulation of air when planted near buildings.

The shape and size of most shade trees can be controlled by systematic pruning; as a rule the slow-growing hard-wooded trees are able to withstand pruning better than the quick-growing, soft-wooded species.

The trees and palms recommended as most suitable for planting on roadsides and in open spaces are grouped for convenience under the following headings:—

(a) Shade trees.
(b) Avenue trees.
(c) Ornamental palms.

It should be pointed out that the individual members in each group have been arranged alphabetically according to their botanical names and have not been placed in an order of merit.

Further, the measurements of both height and spread in the descriptions of the various trees and palms refer to their development in Malaya and bear no comparison to their size in their native habitats.

In this connexion it should be pointed out that the spread of a tree refers to the horizontal distance from the trunk to the tip of the longest branch; in other words the spread represents the radius of the circle of ground occupied by the tree.

To facilitate reference, the measurements of height, spread, and planting distance have also been summarized in Appendix 'A'.

(a) Shade Trees.

The trees described under this heading are considered to be the most suitable for providing roadside shade as they have a spreading habit of growth, which produces the maximum amount of shade.

(1) *Albizzia falcata* (Leguminosae), Batai.

A large, very quick-growing, soft-wooded tree attaining a height of over 100 feet. This is one of the quickest growing trees in Malaya, but its fine feathery foliage does not provide very heavy shade. The spread of the branches from the trunk is from 50 to 60 feet and the trees should be planted from 100 to 120 feet apart. Alternatively, the trees may be planted from 50 to 60 feet apart with a view to cutting out every alternate tree later. A drawback to this tree is that its wood is very soft and the branches are apt to break and fall off without any warning. The tree is also known under the botanical name of *A. moluccana*.

(2) *Delonix regia* (Leguminosae), Flame-tree and Flamboyant, but often known in Malaya as Flame of the Forest.*

A beautiful tree, with scarlet or orange-yellow flowers and fine feathery foliage, native of Madagascar. It is not a very rapid grower, but attains a height of 40 to 50 feet when mature. The tree has a spreading habit and the branches may spread from 30 to 40 feet from the trunk. It is frequently necessary to cut back some of the long thin branches in order to improve the shape of the crown, but fortunately the tree is able to withstand light pruning. For roadside purposes the trees should be planted at a distance of 60 to 70 feet apart. In view of its spreading

* The original flame of the forest tree is *Butea frondosa* (Leguminosae). This tree is a native of India and Ceylon.

habit, it requires a wide thoroughfare to show off its beauty. It is one of the most ornamental trees in the tropics and will thrive both in wet and dry regions. This flowering tree was formerly known as *Poinciana regia*.

(3) *Enterolobium saman* (Leguminosae), Rain Tree. (Plate I).

This is a large, quick-growing tree, native of tropical America. It often attains a height of over 100 feet and is very long-lived. Its wide spreading habit produces very good shade and it is therefore an excellent tree for roadside purposes. It requires a certain amount of pruning, however, to improve its shape and this may reduce the ultimate height of the tree. To prevent the development of very large branches, the tree should be cut across the crown at a height of about 12 to 15 feet, but this operation will naturally restrict the spread of the crown. The spread of the branches of old trees from the trunk may eventually reach from 50 to 60 feet, consequently the trees should be planted at least 50 to 60 feet apart and every alternate tree cut out as the spread of the branches increases with age. This will give a final spacing of 100 to 120 feet apart when the trees are mature. The small leaves, which form a dense shade during the daytime, have the habit of closing up at night. The tree has somewhat large spreading shallow roots which may cause damage to adjoining drains and footpaths if left unpruned.

The rain tree is undoubtedly the most widely planted roadside shade tree in Malaya and was formerly known botanically as *Pithecolobium saman*.

(4) *Mimusops elengi* (Sapotaceae), Bunga Tanjong.

A medium-sized flowering tree, attaining a height of 40 to 50 feet when fully grown, which was probably introduced from India. It produces white flowers which are fragrant, but not very showy. The tree is somewhat slow-growing and the wood is naturally hard as a result; consequently it is fairly free from attacks of "white ants." The spread of the branches from the trunk is from 25 to 30 feet and the trees should be planted about 50 to 60 feet apart for avenue purposes. It forms a well shaped, bushy crown in the early stages of growth, but on reaching maturity it is necessary to prune the branches so as to keep the crown more symmetrical. Although it is considered more suitable as an avenue tree it might also be employed as a roadside shade tree.

(5) *Muntingia calabura* (Tiliaceae), West Indian Cherry.

This is a small or medium-sized tree, rarely exceeding a height of 25 to 30 feet. The tree is a native of tropical America and was introduced into this country only about thirty years ago. The closely-leaved branches, which are at right angles to the trunk, give the crown an umbrella-shaped appearance. The spread of the branches from the trunk varies from 15 to 20 feet, so that the trees should be planted from 30 to 40 feet apart to prove effective. It is a very quick-growing tree and reaches maturity within about 4 years. It will, however, produce excellent shade

at a little over a year from planting, when the branches will have a spread of at least 8 to 10 feet from the trunk. When the trees are two years old all the lower branches should have been removed to a height of about 8 feet.

The edible pink fruits, which closely resemble a cherry, are formed in great profusion at certain times of the year and are liable to attract bats. The latter are particularly objectionable when the trees are planted near a house or public building as they are very apt to discolour the walls. On the other hand, this objection does not apply to native buildings made of corrugated iron, wood or *atap* and in such cases the tree is most popular and, moreover, very effective as a shade tree for this particular purpose.

(6) *Parkia javanica* (Leguminosae), Kedawang.

A huge, handsome, quick-growing tree, native of India and Burma. This tree, which thrives best in moist situations, often attains a height of over 80 feet. It has a clean trunk and beautiful feathery foliage. The spread of the branches from the trunk is from 30 to 40 feet and the most suitable spacing for the trees is from 60 to 80 feet for roadside purposes. This tree is also known under the name of *P. roxburghii*.

Another species, indigenous to Malaya, is *P. speciosa*, which is not so tall-growing as that described above.

(7) *Peltophorum pterocarpum* (Leguminosae), Batai. (Plate II).

This is a medium-sized, quick-growing flowering tree, indigenous to Malaya, reaching a height of about 40 to 50 ft. It is symmetrical in shape with a fairly wide spreading crown, which makes it very suitable as a roadside shade tree. The flowers are a rusty yellow colour and are borne in erect panicles. The tree generally blossoms twice a year at irregular intervals and it is not unusual to see one tree fruiting and another flowering at the same time. The feathery foliage gives the tree a very graceful appearance and this is further enhanced when the young leaves and shoots appear covered with a brown velvety tomentum. When fully grown it has a spread of about 25 to 30 feet from the trunk and consequently should be set back at least 15 feet from the edge of the road. Under good soil conditions the trees should be planted from 50 to 60 feet apart. The tree can withstand hard pruning and it is often necessary to cut off the lower branches, which may impede traffic on the road. It is a most handsome tree for wide thoroughfares and is suitable for cultivation in dry as well as in wet districts. The Malay name "Batai" is also applied to a few allied leguminous trees, and *Albizzia falcata* bears the same local name. The tree was formerly known botanically as *P. ferrugineum*.

(8) *Pongamia pinnata* (Leguminosae), Indian Beech.

This is a medium-sized tree found growing principally in the coastal districts of Malaya, where it reaches a height of 50 to 60 feet. The glossy-green leaves are very small, and numerous, long, thin, leggy branches are produced in the crown.

Rain Tree (*Enterolobium saman*).

Peltophorum pterocarpum.

Its shape can, however, be improved by periodic pruning, more particularly in the early stages of growth, when it should be restricted to a single shoot on the bole. The spread of the branches from the trunk is from 25 to 30 feet and the trees should be spaced about 50 to 60 feet apart when planted as roadside shade. The tree is evergreen and always produces shade during the severest drought. It was formerly named *P. glabra.*

(9) *Pterocarpus indicus* (Leguminosae), Angsana. (Plate III).

A tall-growing, handsome tree, native of India and Burma, attaining a height of 80 to 100 feet. It can be propagated either by seed or cuttings. The tree produces masses of bright yellow flowers, which make it most attractive as a roadside tree. The spread of the branches from the trunk of a well-developed Angsana may extend to as much as 50 to 60 feet and, therefore, the trees should be spaced from 100 to 120 feet apart when planted for shade purposes. Although the branches seldom break, a serious drawback is that the tree is liable to suffer from what is known as "Angsana disease," which frequently results in the death of affected trees. It is extensively planted as a roadside shade tree, but requires a deep well-drained soil for its proper development.

(10) *Tamarindus indica* (Leguminosae), Tamarind.

This is a handsome, tall-growing, erect tree sometimes reaching a height of 60 to 80 feet. It is symmetrical in shape with fine feathery foliage, which makes it most suitable as a roadside tree. It is a slow-growing, long-lived tree and is noted for its hard and beautifully marked red timber. The spread of the branches from the trunk is from 25 to 30 feet and the trees should be spaced from 50 to 60 feet apart for roadside planting. It is commonly planted as a roadside shade tree in India and is stated to thrive well in both moist and dry districts.

Recommendations for Shade Trees.

Of the above ten trees the Angsana, *Pterocarpus indicus,* and the rain tree, *Enterolobium saman,* are the most generally satisfactory for wide main thoroughfares provided there is plenty of space to enable the trees to be sited well back from the road edge and to allow unrestricted development of both stem and root. If planted near the edge of the road the roots of the rain tree are liable to cause unevenness of the road surface. There is some danger of the road surface being rendered slippery if wet weather occurs at the time the Angsana is shedding its flowers. *Albizzia falcata,* though very suitable for providing a pleasant shade for wide roads, has brittle wood, so is not suited for main thoroughfares. For less wide roads or for wide roads where space is somewhat restricted or full shading of the road is undesirable, *Peltophorum pterocarpum* is a very suitable tree.

As many town authorities have experienced trouble with large specimens of Angsana and rain trees which have become dangerous to adjoining shop-houses, there is now a tendency to plant smaller-growing trees. Peltophorum has been

extensively planted recently and, when in flower, an avenue of this species forms a fine display. The Tamarind, *Tamarindus indica,* has a more sombre and therefore less pleasing general effect than Peltophorum and is of much slower growth. The Flamboyant (locally called Flame of the Forest) is often unsatisfactory in inland districts with a high rainfall and grows and flowers better in seaside areas or in comparatively dry regions.

(b) Avenue Trees.

The trees included in this group have, for the most part, an erect habit of growth and, therefore, are more useful for ornamental than for shade purposes.

(1) *Cassia fistula* (Leguminosae), Indian Laburnum.

A very handsome flowering tree of upright growth, native of India, attaining a height of 40 to 50 feet. It thrives best on rich loamy soils and in dry situations. It bears a profusion of bright yellow flowers in pendulous racemes, similar to the laburnum, and is deciduous. The spread of the branches from the trunk is from 15 to 20 feet and the trees should be planted at a distance of about 35 to 40 feet apart. It never forms a very large tree and is more suited for ornamental than for shade purposes.

(2) *Dryobalanops aromatica* (Dipterocarpeae), Borneo Camphor.

This is a lofty, erect-growing, conical-shaped tree, indigenous to Borneo and Sumatra, and under cultivation it attains a height of over 80 feet. Like tembusu, this tree has the habit of branching low down and requires pruning for roadside planting, particularly if there is a foothpath nearby. The spread of a mature tree is from 15 to 20 feet from the trunk. The tree should be planted at a distance of 35 to 40 feet apart for roadside purposes. It is similar in habit of growth to the ironwood and, in view of its conical shape, does not produce much shade.

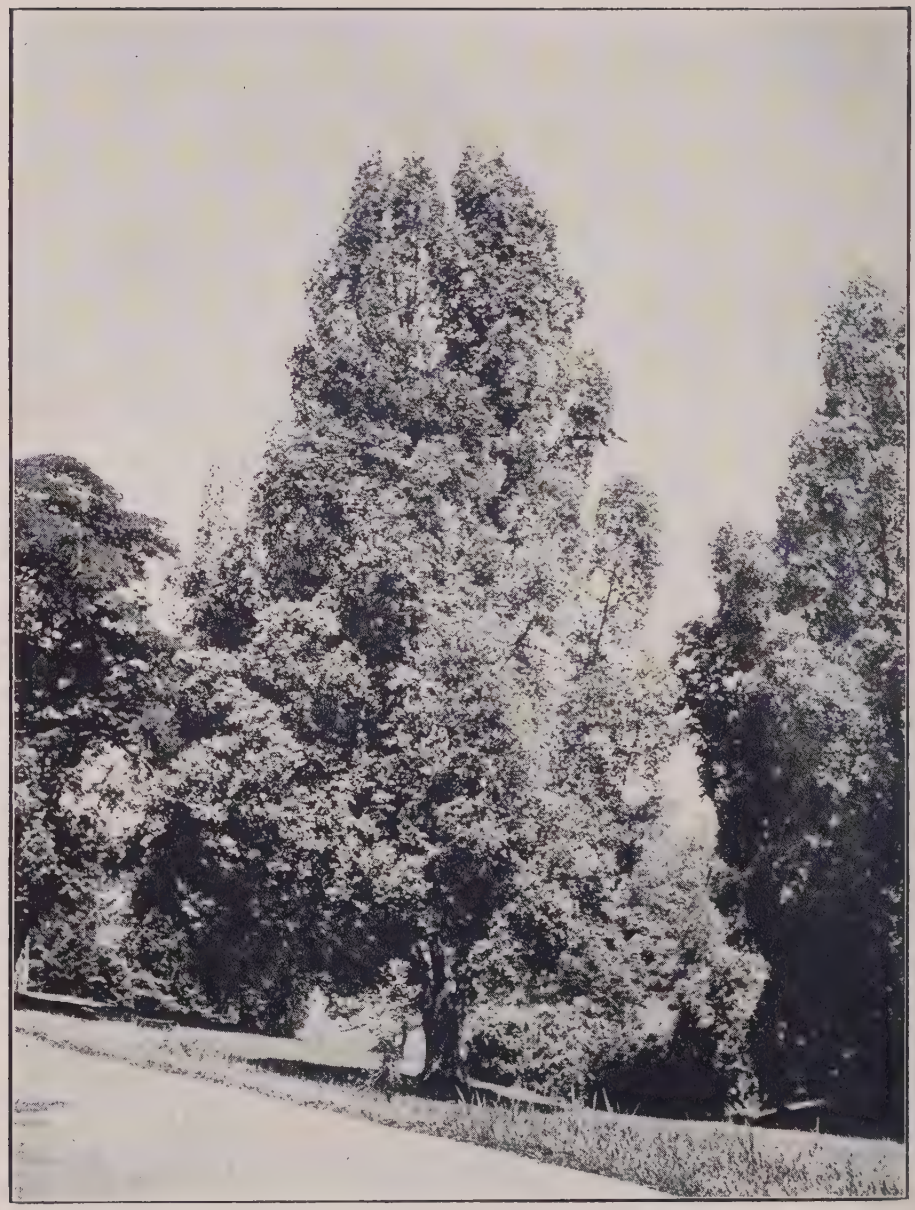
(3) *Eugenia grandis* (Myrtaceae), Jambu Ayer Laut.

This indigenous, tall, quick-growing tree reaches a height of about 70 to 80 feet and has an erect habit similar to the tulip tree. Although it is a quick-growing tree the wood is comparatively hard. The spread of the branches from the trunk varies from 15 to 20 feet and the trees should be spaced from 35 to 40 feet apart. For avenue purposes the main trunk should not be allowed to grow more than 40 to 50 feet high. It is an excellent roadside tree for dry sandy situations and is often found growing near the seaside, hence its Malay name.

(4) *Fagraea cochinchinensis* (Loganiaceae), Tembusu. (Plate IV).

A handsome, upright, evergreen tree, indigenous to the Malay Peninsula, and very suitable for avenue planting. This tree,like the ironwood, has the habit of branching low down and, therefore, is more suited for wide roads. It is of a slow-

Angsana (*Pterocarpus indicus*).



Tembusu. (*Fagraea cochinchinensis*).

growing nature and the wood is so hard that it does not suffer to any extent from "white ant" attacks. The small flowers are highly scented, the perfume somewhat resembling that of the honeysuckle. Under suitable conditions the tree attains a height of over 60 feet, and for roadside purposes it is advisable to top it when it reaches a height of about 40 feet. Fortunately the tree will stand hard pruning, so that it is easy to control its shape and size. The spread of the branches from the trunk is from 15 to 20 feet and the trees should be spaced from 35 to 40 feet apart when planted in an avenue. This tree is also known botanically as *F. fragans* and *Cyrtophyllum peregrinum*.

(5) *Grevillea robusta* (Proteaceae), Silky Oak.

This is a fairly tall-growing tree, native of southern Australia, and thrives quite well in dry situations in this country. The tree has an erect stem and attains a height of 60 to 70 feet. The fern-like foliage, which is silvery-white underneath, gives the tree a very ornamental appearance. The spread of the branches from the trunk is from 12 to 15 feet and the planting distance for these trees should not exeed 30 to 35 feet apart for avenue planting. Although it will grow on the plains in Malaya it is more suited for cultivation at higher elevations. Unfortunately, this tree is somewhat liable to attacks by "white ants."

(6) *Jacaranda mimosifolia* (Bignoniaceae), Jacaranda.

This beautiful flowering tree is a native of tropical America and reaches a height of 50 to 60 feet. It bears masses of bluish-purple, bell-shaped flowers, which are most attractive. Its fine feathery foliage gives only a medium shade and when the leaves fall in the hottest season the tree is absolutely bare and gives no shade at all. Unfortunately this tree generally has a bad bole and branches low down. It grows best in moist situations. The spread of the branches from the trunk is from 15 to 20 feet and the most suitable spacing for these trees is from 35 to 40 feet apart. The wood is fairly hard and the tree will stand hard pruning when necessary. This lovely flowering tree is also known as *J. ovalifolia*.

(7) *Lagerstroemia speciosa* (Lythraceae), Pride of India.

A fairly tall, spreading tree, native of India and Malaya, attaining a height of 50 to 60 feet. It is one of the most showy flowering trees and bears erect panicles of beautiful mauve or pink flowers from the ends of the branches. The pink flowering type is, however, very rare and mauve is the predominating colour. Although the tree is not so symmetrical as Peltophorum, its bright mauve flowers make it specially attractive. A slight drawback is that as the tree gets older it becomes deciduous for a short period during the dry season. As it is very slow-growing the wood is hard and therefore not subject to attacks of "white ants." The trees have a spread of 20 to 25 feet from the trunk and should be planted from 45 to 50 feet apart for roadside purposes. This tree is adapted for cultivation in wet or swampy localities and is therefore particularly suitable for planting in low-

lying situations. As stated above, it is indigenous to Malaya and is frequently found growing in jungle swamps in this country. The tree was formerly known as L. *flos-reginae*.

(8) *Melaleuca leucadendron* (Myrtaceae), Cajeput.

This graceful, erect tree is indigenous to Malaya, where it is found growing on both coasts. It has fine feathery foliage and fibrous, scaly bark, which peels off in large strips. The tree is variable in size, depending on soil conditions, but often attains a height of over 50 feet. It thrives best in wet situations and will even grow in standing water. The spread of the branches from the trunk may vary from 15 to 20 feet and when planted for avenue purposes the trees should be spaced from 35 to 40 feet apart. This tree has not sufficient spread to shade wide roads, but has been used with success as a shade tree on the narrow roads in Malacca.

(9) *Mesua ferrea* (Guttiferae), Ironwood. (Plate V).

A medium-sized, slow-growing, conical-shaped tree, indigenous to India and Malaya, attaining a height of over 80 feet. It has a symmetrical habit, but branches rather close to the ground. The young foliage, which is produced twice a year, is of a beautiful crimson colour and gives the tree a most striking appearance. The spread of the branches from the trunk is about 15 to 20 feet and when planted as an avenue tree it should be spaced about 35 to 40 feet apart. In view of its low-branching habit it is only suitable for very wide roads and should be set back at least 20 feet from the edge of the roadway. Since the tree is very slow-growing the timber is extremely hard, as its common name implies.

(10) *Spathodea campanulata* (Bignoniaceae), Tulip Tree.

A tall-growing, erect tree, native of tropical Africa, reaching a height of 70 to 80 feet. It is a free-flowering tree and its masses of orange-scarlet, cup-shaped flowers render it very ornamental. The spread of the branches from the trunk is from 15 to 20 feet and on account of its erect habit the tree does not produce much shade. A suitable planting distance is from 35 to 40 feet apart as an avenue tree. A serious objection is that the tree is soft-wooded and the trunks of old specimens are very liable to become hollow in the centre; consequently it is dangerous when growing near buildings or on roadsides when it is old.

Recommendations for Avenue Trees.

The tembusu, *Fagraea cochinchinensis*, is one of the commonest ornamental trees in this group but is not entirely satisfactory as an avenue tree owing to its habit of branching. The tree forms branches widest at the base and thus a considerable amount of pruning is necessary. It grows well on the hardest clay soil and is most satisfactory in the open where the full beauty of its outline is shown.

The jacaranda, *Jacaranda mimosifolia*, thrives fairly well in the drier parts of the country but is erratic in its behaviour and rarely forms a uniform avenue of trees. The tulip tree, *Spathodea campanulata*, is often a striking tree and perhaps with

Ceylon Iron Wood (*Mesua ferrea*).

Royal Palm (*Roystonea regia*).

careful attention to branch pruning might be kept in better shape. *Eugenia grandis* was extensively planted as an avenue tree in Singapore in the past but does not appear to be so popular now. Several of the other trees mentioned have been experimentally planted during recent years but are as yet too young to decide whether they are suitable for the purpose.

(c) Ornamental Palms.

The palms grouped under this heading have upright, unbranched stems and most of them are naturally more suitable for ornamental purposes than for producing shade. They will, however, be found just as effective when planted in avenues as in open spaces.

(1) *Areca catechu* (Palmae), Arecanut or Betel-nut Palm, "Pinang."

This tall, graceful palm is indigenous to Malaya and produces the arecanuts of commerce. Its cultivation extends throughout tropical Asia. The palm has an erect, clean, solitary stem and often attains a height of 60 to 70 feet. The spread of the leaves varies from 4 to 6 feet from the stem, according to the variety. For ornamental purposes a suitable distance of planting arecanut palms is from 12 to 15 feet apart. It is an excellent palm for avenue planting and may live for 50 or 60 years under suitable soil conditions.

(2) *Arenga pinnata* (Palmae), Sugar Palm, "Kabong."

The sugar palm is also a native of the Malay Peninsula and has a stout, spineless trunk with long, rather upright, pinnate leaves, which often attain a length of 20 feet or more. This palm grows to a height of about 50 to 60 feet and, as its common name implies, it produces the dark brown native sugar, which is obtained by tapping the inflorescence in the same way as that practised for extracting toddy from the coconut palm. The leaves, which are more or less erect in their habit of growth, have a spread of about 15 to 18 feet from the trunk and the palms should be planted from 35 to 40 feet apart. As the tree is comparatively short-lived, usually only about 15 or 20 years, it is more useful for ornamental purposes in open spaces rather than for avenue planting. This palm was formerly known under the botanical name of *A. saccharifera*.

(3) *Borassus flabellifera* (Palmae), Palmyra Palm.

The palmyra palm is a native of India and tropical America and is occasionally planted in the Malay Peninsula as an ornamental palm. It has an erect, ringed stem and attains a height of 50 to 60 feet. The globe-shaped crown of fan-shaped leaves has a spread of 6 to 8 feet from the trunk and the most suitable distance for avenue planting of these palms is from 20 to 25 feet apart. The palm thrives best in very dry situations and requires a rich soil and good cultivation for its

proper development in the southern parts of the Malay Peninsula. It is a very slow-growing palm, but will live for 50 to 60 years. In India and Ceylon, this palm is extensively tapped for toddy in the same way as the coconut palm.

(4) *Caryota urens* (Palmae), Toddy or Wine Palm.

This handsome palm is indigenous to India and Ceylon and it is commonly cultivated in both these countries, where it is tapped for toddy in the same way as the coconut palm is in this country. The palm is also cultivated to some extent in gardens in Malaya. It is a tall palm with a stout, ringed trunk often reaching a height of 40 to 50 feet and has large ascending leaves from 15 to 18 feet long. The spread of the crown is about 12 to 15 feet from the trunk to the tip of the leaves. The distance of planting in avenues should be from 30 to 35 feet apart. The palm is comparatively short-lived and dies at the age of about 20 to 25 years.

(5) *Cocos nucifera* (Palmae), Coconut Palm, "Nyior" or "Kelapa."

The coconut palm is to be found cultivated in almost every part of the Peninsula and is too well known from the commercial standpoint to need much description. It is a very ornamental palm and grows to a height of 70 to 80 feet. The palm is principally cultivated for the production of the copra of commerce, which merely consists of drying the kernel, while in addition the unopened flower spathes are commonly tapped for the production of toddy. It has also many other uses in native industry. The great objection to planting this palm in avenues on streets or roadsides is the danger of nut fall, but this can be easily controlled by removing the flowering spathes as they develop. For ornamental purposes in open spaces the tall variety possibly has no equal. Its large drooping leaves, which vary from 20 to 25 feet in length, have a spread of 12 to 15 feet from the trunk. The most suitable distance of planting for these palms in avenues is from 30 to 35 feet apart, but when planting in groups of say seven or more the spacing should be reduced to 25 to 30 feet apart each way.

There are also three dwarf varieties with green, red and yellow fruits respectively, but the shape of these trees is not so beautiful as the tall type. The dwarf varieties should be planted at a distance of 25 to 30 feet apart to prove effective.

(6) *Cocos plumosa* (Palmae), Feathery Coconut Palm.

This particularly graceful palm is a native of Brazil and grows to a height of about 30 to 40 feet. It has an erect trunk, which is ringed at intervals of about 12 inches. Its fine feathery leaves, which have a drooping habit, spread only about 6 to 8 feet from the trunk and the best planting distance for these palms is from 20 to 25 feet apart. This is a fairly long-lived and comparatively quick-growing palm. It is preferred to the closely related *Cocos nucifera* for avenue planting from every standpoint, and is also excellent for ornamental purposes.

(7) *Corypha umbraculifera* (Palmae), Talipot or Fan-Palm.

This majestic palm is indigenous to Ceylon and South India and has enormous fan-shaped leaves measuring from 10 to 12 feet in diameter. It has a stout, erect, roughish stem 3 to 4 feet in diameter and grows to a height of 50 to 60 feet when mature. The spread of the leaves from the trunk to the tips is about 20 to 25 feet, and the palms should be spaced from 45 to 50 feet apart in the avenues. Owing to its large size this palm should only be planted where there are very wide road reserves. The palm usually flowers at about 30 to 35 years, after which it dies.

(8) *Cyrostachys lakka* (Palmae), Sealing-wax Palm, "Pinang-raja."

The sealing-wax palm is a native of Sumatra and Malaya and has multiple, spineless stems with bright red leaf-sheaths, which make it most attractive. The palms will grow to a height of 30 to 40 feet or even more under good soil conditions. The spread of the leaves from the centre of the palm varies from 6 to 8 feet, so that a good distance of planting these palms is from 20 to 25 feet apart. This palm is not very suitable for avenue planting on account of its numerous stems, but it is excellent for ornamental purposes in open spaces. Although it is to be found growing in swamp forests in different parts of the Peninsula the palm will thrive on drained flat land as well as on high ground.

(9) *Elaeis guineensis* (Palmae), Oil Palm.

This handsome palm is a native of tropical West Africa and is often referred to as the African oil palm. It attains a height of 60 to 70 feet and is now commonly grown in Malaya for its bright orange-red fruits, which produce the palm oil and palm kernels of commerce. The palm has a stout, erect stem and when the leaves are removed by pruning it is covered with numerous leaf bases. It has fine spreading leaves, which are often over 20 feet in length. The spread of the leaves from the trunk to the drooping tips is from 15 to 18 feet, and for ornamental purposes the palms should be planted from 35 to 40 feet apart in avenues or open spaces. It is one of the quickest growing palms and will attain a height of about 25 to 30 feet within four or five years. This is one of the most suitable palms for avenue planting and, like the coconut palm, is very long-lived under suitable soil conditions.

An objection to this palm is the litter arising from rotting male inflorescences and falling fruit. This can, however, be controlled to a large extent by cutting out both the male and female inflorescences as they develop.

(10) *Livistona chinensis* (Palmae), Chinese Livistona.

This very fine palm is a native of China and Japan and attains a height of 40 to 50 feet. It has a fine crown of fan-shaped leaves which spread about 6 to 8 feet from the trunk. The palms should be planted at a distance of 20 to 25 feet apart under good soil conditions. It is very suitable for avenues as well as for ornamental planting in open spaces.

(11) *Roystonea oleracea* (Palmae), Cabbage Palm.

The cabbage palm is a very tall-growing palm, indigenous to tropical America, and reaches a height of 70 to 80 feet. The spread of the leaves from the trunk varies from 12 to 15 feet so that the planting distance of these palms should be from 30 to 35 feet apart. This palm is most effective for avenue planting and compares very favourably with the closely related *R. regia* (Oreodoxa), the leaves of which are more drooping and feathery in their habit. The trunk is smooth and thickened at the base, the remainder being more or less cylindrical, whereas the stem of the royal palm is swollen upwards giving it a barrel-shaped appearance. The leaves, which are about 15 feet long, are spreading and only slightly drooping at the tips.

(12) *Roystonea regia* (Palmae), Royal Palm. (Plate VI).

This most elegant palm is a native of Cuba, Panama and other parts of tropical America and on account of its peculiar barrel-shaped stem it is also known as the "bottle palm." This palm, which has a straight, clean trunk, attains a height of 50 to 60 feet. Under suitable soil conditions the feathery drooping leaves of these palms have a spread of 10 to 12 feet from the trunk and the best distance for planting is from 25 to 30 feet. For avenue planting the palms should not be spaced less than 25 feet apart as a fair open space between the palms helps to show off their beauty. Consequently, when the soil conditions are good the spacing should be 30 feet apart to produce the best effect. This stately palm is undoubtedly one of the most effective trees for both ornamental and avenue planting and is well and truly named the royal palm. It was formerly known botanically as *Oreodoxa regia*.

Recommendations for Ornamental Palms.

Several of the palms mentioned form effective avenues of light shade and are very ornamental in appearance. The Royal Palm, *Roystonea regia,* is perhaps the best and should be more extensively planted. Where space is more restricted, *Cocos plumosa* may be selected and forms a uniform avenue of pleasing appearance. Since it is not possible to prune or otherwise control the growth of palms as in the case of dicotyledonous trees, special care must be exercised in selection of site. Most species of palms do not form much litter and are not particular as to their soil requirements. They often will thrive in sandy soil where trees would be a failure.

Method of Planting.

Considerable care and attention is necessary in the planting of roadside trees and, as far as possible, the following recommendations should be observed.

Propagation.—To raise young trees a nursery or propagating ground is necessary and it is important that the site selected should be in a well-sheltered position. The beds should be arranged in rows about 4 feet wide and consist of a good loamy soil, containing a fair proportion of sand.

The majority of the trees can be propagated from seed, but if this is not available either cuttings or layering may have to be adopted. Trees in the nursery should stand fairly close together if required for roadside planting as this ensures straight and clean trunks and a well-developed crown. The quick-growing trees may be ready to transplant at the end of a year, while slow-growing varieties and palms may take from $1\frac{1}{2}$ to 2 years before they are ready to be transferred to their permanent quarters.

Distance of Planting.—An approximate indication of the ultimate planting distance has been given when describing individual trees and palms.

If, however, the plan is to develop a quick shade a fast growing medium-sized tree, such as Peltophorum, could be chosen, the individual trees being planted at half the ultimate distance, say 30 to 35 feet, and alternate trees removed later. When quick shade is not required it would be more economical to plant 60 to 70 feet apart at the outset.

When complete shade is required the planting distance should be so gauged that the branches of any tree will touch those of the adjoining neighbour, so as to form a continuous canopy along the roadside. In the case of ornamental palms, however, a much better appearance will be obtained if space is left between the palms forming the rows. For example, if the crown of any particular palm has an overall spread of say 15 to 20 feet, the distance of planting such palms should be from 25 to 30 feet, thus giving a space of about 10 feet between the crowns of the palms.

Holing.—The holes for the trees should be about 3 feet in diameter and preferably not less than 3 feet deep.

The earth which is removed should be set aside and mixed with cattle manure if available or alternatively with about 8 ozs. of a slow-acting manure, such as steamed bone-meal or other organic fertilizer.

The soil at the bottom of the hole should be thoroughly broken up, after which the treated earth is replaced.

In cases where the soil is very poor it should be replaced partly or wholly with good surface soil from elsewhere.

The holes should be filled to slightly above ground level and allowed to stand for at least seven days until the mounded soil sinks and becomes more compact.

Planting.—Planting should be commenced at the beginning of a wet season, say in October or November and March or April. When space is available the trees should not be planted less than 12 to 15 feet from the side of the road, due allowance being made for any possible future widening of the road. Care should be taken to see that the seedling trees are not planted too deep and the soil should be worked well amongst the roots. Further, it is important that the soil should be well trodden round the roots to make the tree firm, otherwise it will dry out and may die. The young trees should be watered immediately after planting.

A useful method of protecting the trees from a setback when they are planted out on country roads where supervision cannot be continuous is to grow the seedling originally in a small basket, then to replant the small basket in a larger basket filled

with suitable earth and then to plant the larger basket in the actual roadside hole. This generally allows the tree to establish itself vigorously before it has to contend with the normal hardships of a tree planted in poor soil on a roadside.

As a general rule it is never advisable to plant more than two different varieties of trees in any particular road and when two varieties are alternated with one another it is important to see that they are more or less of the same habit of growth, both as regards height and form.

In planting narrow roads with trees which have a flat spreading crown, such as the rain tree, the trees on one side should be planted midway between those on the other side of the road in order to allow ample room for expansion and to produce a better shade.

In the case of palms which have a similar habit of growth the interplanting of different varieties often produces a considerable improvement.

Watering.—If the weather is dry after planting, the plants should be regularly watered until they are well established. In carrying out this operation a thorough soaking of the soil around the plants is essential.

Shading.—To protect the young trees from the hot sun some form of temporary shade should be provided for a week or two after planting them in the open. Fern fronds and palm leaves will be found most suitable for this purpose as they furnish the requisite amount of shade, which should not be too dense.

Maintenance of Trees and Palms.

Once the plants are established there remains the question of upkeep; the proper maintenance of the young trees is of equal, if not of greater, importance than the operation of planting. Due attention should therefore be given to the following problems as they arise.

Staking.—When the trees attain a height of 3 to 4 feet they should be securely staked to keep them perpendicular. At first the stakes should be about 4½ to 5 feet long so as to allow of at least 2 feet being driven into the ground, but as the trees get larger, stakes about 8 feet long will be required; this applies more particularly to the quick-growing varieties, which are apt to become somewhat leggy in the early stages of their development.

The young trees should be secured to the stakes with strong tarred twine or rope, which should be loosely tied to allow of expansion of the trunk. On no account should wire be used for trying the young trees to the stakes.

Tree Guards.—The newly-planted trees will require to be protected by guards of wood or iron. Circular iron guards are made in two sections which are bolted together, and these cost about $10 each. A good cheap guard, however, can be made by placing three posts in triangular fashion round the tree and nailing them together by two or three rows of rails, or alternatively using four posts to form guards about three feet square. These guards, made of 2 inch square timber, should be at

least 4 feet from the ground and covered on the sides with 1½ inch mesh wire netting to afford further protection from animals. Such guards, made of soft timber covered with a coat of solignum or other wood preservative, would not cost more than $2 each.

Cultivation.—A space of 2 to 3 feet round the base of the trees should be kept surface tilled and free from grass and weeds. This area should occasionally be mulched with well-decayed manure or litter, when available.

Pruning.—Pruning should receive early attention and any long, straggling shoots should be cut back in order to produce a compact crown. If young shoots or suckers are thrown out from the base of the tree they should be removed as soon as they appear. In pruning large branches they should always be removed close to the main trunk and all cuts made clean and tarred to prevent decay. To prevent the bark being torn away in unsightly strips it is advisable first of all to make an incision of the bark on the underside of the branch and then to cut it off a little higher on the upperside.

The question of pruning generally requires very careful consideration and it is not uncommon to find trees mutilated as a result of this operation. The principal aim of pruning is to obtain a clean trunk and a well-balanced crown, which demands a certain amount of practical experience.

It is frequently desirable to prune the tops of the young trees after about one or two years' growth, as this tends to give the crowns a much better shape.

Pests and Diseases.—A careful watch should be kept for "white ant" attacks, which may prove troublesome and cause serious damage if neglected. Some form of disease occasionally attacks palms, particularly the royal palm, and this generally results in the death of the palm. In such cases the only alternative is to remove the diseased or dead palm and replant with fresh stock.

The trees should also be periodically examined for parasites, such as Loranthus, which, if not removed early, become highly injurious and will eventually sap the vitality of the tree.

Manuring.—Manure should be applied regularly to the trees until they are about five years old, special attention being given to those which are backward. A dressing of 6 to 8 baskets of well-decayed cattle manure per tree once or twice a year will usually be found sufficient and this should be dug into the soil round the base of the tree. When cattle manure is not available an application of ½ to 1 lb. of steamed bone meal or some other slow-acting fertilizer may be used as an alternative, double the quantity being applied to any stunted trees.

General.

If the detailed operations are to be properly carried out any attempt at large scale road planting will prove an expensive operation. In the circumstances it is recommended that not more than three or four fairly long roads should be planted each year according to the funds available.

In conclusion it cannot be emphasised too strongly that it is insufficient to plant trees or palms at stated distances and leave them to take care of themselves. Both trees and palms need regular attention if full benefit is to be derived from having introduced them into the particular planning scheme. It is only in the way described in this article that the amenities of any scheme can be preserved indefinitely.

Acknowledgment.

The author wishes to acknowledge the assistance of Mr. H. D. Meads of this Department in supplying the photographs illustrating this article.

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Appendix "A"

List of Trees and Palms for Planting on Roadsides and in Open Spaces.

Serial No.	Botanical Name	Common Name	Height	Spread	Distance of Planting
			feet	feet	feet
	(a) Shade Trees.				
1.	*Albizzia falcata*	Batai ...	+ 100	50 — 60	100 — 120
2.	*Delonix regia*	Flame-tree ...	40 — 50	30 — 40	60 — 70
3.	*Enterolobium saman*	Rain Tree ...	+ 100	50 — 60	100 — 120
4.	*Mimusops elengi*	Bunga Tanjong ...	40 — 50	25 — 30	50 — 60
5.	*Muntingia calabura*	West Indian Cherry ...	25 — 30	15 — 20	30 — 40
6.	*Parkia javanica*	Kedawang ...	+ 80	30 — 40	60 — 80
7.	*Peltophorum pterocarpum*	Batai ...	40 — 50	25 — 30	50 — 60
8.	*Pongamia pinnata*	Indian Beech ...	50 — 60	25 — 30	50 — 60
9.	*Pterocarpus indicus*	Angsana ...	80 — 100	50 — 60	100 — 120
10.	*Tamarindus indica*	Tamarind ...	60 — 80	25 — 30	50 — 60
	(b) Avenue Trees.				
1.	*Cassia fistula*	Indian Laburnum ...	40 — 50	15 — 20	35 — 40
2.	*Dryobalanops aromatica*	Borneo Camphor ...	+ 80	15 — 20	30 — 40
3.	*Eugenia grandis*	Jambu Ayer Laut ...	70 — 80	15 — 20	35 — 40
4.	*Fragraea cochinchinensis*	Tembusu ...	+ 60	15 — 20	35 — 40
5.	*Grevillea robusta*	Silky Oak ...	50 — 60	15 — 20	35 — 40
6.	*Jacaranda mimosifolia*	Jacaranda ...	50 — 60	15 — 20	35 — 40
7.	*Lagerstroemia speciosa*	Pride of India ...	50 — 60	20 — 25	45 — 50
8.	*Melaleuca leucadendron*	Cajeput ...	+ 50	15 — 20	35 — 40
9.	*Mesua ferrea*	Ironwood ...	+ 80	15 — 20	35 — 40
10.	*Spathodea campanulata*	Tulip Tree ...	70 — 80	15 — 20	35 — 40
	(c) Ornamental Palms.				
1.	*Areca catechu*	Arecanut Palm ...	60 — 70	4 — 6	12 — 15
2.	*Arenga pinnata*	Sugar Palm ...	50 — 60	15 — 18	35 — 40
3.	*Borassus flabellifera*	Palmyra Palm ...	50 — 60	6 — 8	20 — 25
4.	*Caryota urens*	Toddy or Wine Palm ...	40 — 50	12 — 15	30 — 35
5.	*Cocos nucifera*	Coconut Palm ...	70 — 80	12 — 15	30 — 35
6.	*Cocos plumosa*	Feathery Coconut Palm	30 — 40	6 — 8	20 — 25
7.	*Corypha umbraculifera*	Talipot or Fan-Palm ...	50 — 60	20 — 25	45 — 50
8.	*Cyrostachys lakka*	Sealing-wax Palm ...	30 — 40	6 — 8	20 — 25
9.	*Elaeis guineensis*	Oil Palm ...	60 — 70	15 — 18	35 — 40
10.	*Livistona chinensis*	Chinese Livistona ...	40 — 50	6 — 8	20 — 25
11.	*Roystonea oleracea*	Cabbage Palm ...	70 — 80	12 — 15	30 — 35
12.	*Roystonea regia*	Royal Palm ...	50 — 60	10 — 12	25 — 30

TEA REGULATION IN MALAYA

BY
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The development of the Malayan tea industry up to the end of 1938 was described in a previous number of this Journal.* It may be summarized very briefly as follows.

Under the first International Tea Agreement, which terminated on 31st March 1938, Malaya undertook that the area planted between the end of 1936 (when Malaya entered the Agreement) and the date of its termination should not exceed 3,000 acres, and that the total area planted in Malaya by the end of the first Agreement should not exceed 6,000 acres. Owing to a number of reasons, the total area planted by the end of the first Agreement was only 4,716 acres.

When the terms of a second Agreement to run for five years from 1st April 1938 came to be considered a considerable divergence of opinion was found between the various parties concerned. The International Tea Committee, after first proposing that there should be no increase at all beyond the 6,000 acres permitted by the first Agreement, eventually suggested that an extra 1,000 acres might be planted, bringing the Malayan total by the end of the second Agreement to 7,000 acres. The United Planting Association of Malaya suggested a total of 15,000 acres of additional planting by the end of March 1943. To reconcile these divergent viewpoints, the Government requested the United Planting Association of Malaya to form a Tea Planters' Section or Committee, a course on which agreement was reached, and the Committee appointed Sir John Hay as its London representative for the purpose of negotiating with the International Tea Committee.

It was anticipated that these negotiations might prove to be somewhat lengthy, hence the Tea Controller, in order that planting should not be held up while they were proceeding, continued to sanction suitable applications to plant during the period 31st March to the end of 1938. Because of the unfavourable planting weather experienced during the latter part of 1938, licences to plant during this period were extended, first until the end of March, 1939, and later to the end of June, 1939.

After negotiations with the International Tea Committee Sir John Hay forwarded for the consideration of the Malayan Governments and of the Tea Committee of the United Planting Association of Malaya a memorandum which contained, *inter alia*, certain proposals under which Malaya would agree to limit planting during the currency of the second Agreement, which terminates on 31st March 1943, so that the total area to be planted might be expected to produce the equivalent of Malaya's probable future tea consumption. It was estimated that an additional 10,000 acres would be sufficient to ensure this object. With these proposals the

* The Malayan Tea Industry in 1938. D. H. Grist, *Malayan Agricultural Journal*, Vol. XXVII, No. 4, April 1939.

Malayan Governments and the United Planting Association of Malaya agreed, whereupon the International Tea Committee undertook, in April, 1939, to recommend acceptance of these proposals to the Governments of India, Ceylon and Netherlands East Indies, the three principal participants in tea regulation.

In anticipation that such acceptance would be forthcoming and in view of the fact that any further delay would have prejudiced 1939 planting it was decided to anticipate the consent of the participating Governments and a comprehensive communiqué setting forth the proposed terms of the new Agreement was issued to the Malayan press at the end of May, 1939. Shortly afterwards Sir John Hay was advised by the International Tea Committee that the consent of the participating Governments had been obtained, and the Tea Controller, S.S. and F.M.S., was thus authorized to make allocations and to issue licences for the first year's planting, on the 10,000 acre total basis previously mentioned.

The official form of application for licence to plant tea had in the meantime been under consideration by the Malayan Governments and on 5th July, 1939, a second communiqué was issued to the press notifying that applications for licences to plant tea during the period 1939 to March 1943 would be received by the Tea Controller from 6th July to 6th September, 1939, and that applications for such licences must be made on forms obtainable from the Tea Controller.

The amended application form (Schedule C) was gazetted in a Supplementary Gazette (F.M.S.) on the 6th July, 1939. A copy of this, and of a note which accompanies it to applicants, is shown below:—

Schedule C.

The Tea Control Enactment, 1936.

APPLICATION FORM FOR LICENCE TO PLANT TEA.

Sir,

I/We beg to apply for a licence to plant.....acres with tea on my/our property, particulars of which are given below:

Name of owner.....

Description of Land.

State.....

Mukim.....

Particulars of title.....

Name of estate.....

Acreage now planted with tea.....

Particulars of nurseries existing, if any, including approximate number of seedlings therein.....

Proposed source of supply of planting material.....

Planting programme:

1939	...	acres
1940	...	,,
1941	...	,,
1942 and Jan/April 1943	...	,,

Capital expenditure anticipated in

1939	...	$
1940	...	$
1941	...	$
1942 and Jan/April 1943	...	$

I undertake, if required, to furnish proof that I am in a position to provide or obtain capital as indicated above.

Signature of owner.....

Date.....

To

The Tea Controller,
Agricultural Department,
Kuala Lumpur.

Notice to Applicants.

The attention of applicants for licences is directed to the fact that they must in any application made by them under the Tea Control Rules, 1937 (as amended by Gazette Notification No. 3075A of 6th July, 1939, substituting a new form in Schedule C of those Rules) apply for allotment of the aggregate acreage which they intend to plant during the present Tea Regulation period, ending March 31st, 1943; and further that they must in such application set out their annual programmes for that period.

2. If, when allotment is made, the area allotted is less than that which was applied for, applicants will be given the opportunity of readjusting their annual programmes.

3. A licence will then be issued to cover planting in 1939 and 1940; and the balance of allotment will be reserved for the applicant, to whom there will in due course be issued licences to cover 1941 and 1942-1943 (to end March 31st).

4. This reservation and the issue of licences subsequent to the first will, however, be conditional on fulfilment of programme.

5. In the event of non-fulfilment of programme or of the commission of any offence against section 7 of the Tea Control Enactment 1936 the Controller may, at his discretion, withdraw such reservation and issue no further licence.

TEA CONTROLLER,
S.S. & F.M.S.

NOTES ON AN ATTEMPT TO ESTIMATE THRESHING QUALITIES IN PADI

BY

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and
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Padi cultivators in Kedah often refer to certain varieties of padi (*e.g.* Mayang Tekai and Reyong) as "liat," which means that they are difficult to thresh by beating in a tub. Cultivators who harvest their crop with the *ketam*,* and subsequently separate the grain by treading, do not look on this as an undesirable feature, but those who use the tub and screen (*i.e.* by far the majority of padi growers) dislike 'liat' varieties since they render threshing a much longer and more laborious operation. There is, of course, a happy mean as regards this character, and varieties which shatter too easily are equally undesirable since much grain may be wasted during handling.

With a view to comparing the behaviour of different varieties of padi in respect of this character a simple mechanical device was erected at the Telok Chengai Padi Experiment Station, Kedah. Its construction, which is intended to reproduce as far as possible the actual operation of tub-threshing, will be most easily understood from the accompanying photographs. A sheaf of padi, standardized as to weight and length, is fixed into a wooden frame which can be raised and lowered on a horizontal axle. The frame, together with the sheaf, is first raised to the vertical position and then allowed to fall under its own weight. The head of the sheaf strikes an inclined board (such as that used in ordinary threshing) and a certain amount of grain becomes detached. After a given number of strokes the sheaf is weighed again and the amount of grain lost is recorded. The total weight of grain is then calculated by threshing out the remainder and adding its weight to that of the grain previously lost. Thus we can say that, with a certain variety, X per cent. of grain is lost after a given number of strokes; and that, with another variety, Y per cent. is lost after the same number of strokes.

The dimensions of the machine at Telok Chengai are:

Inside breadth of outer framework	....	2 ft. 5 ins.
Height of axle above ground level	...	4 ft. 4 ins.
Internal width of frame holding sheaf	...	11 ins.
Length of frame holding sheaf (tip to axle)	...	2 ft. 8 ins.

Sheafs 3 ft. long and weighing 8 lbs. were used, this being roughly the size of an ordinary sheaf in Kedah.

* A small knife with which the crop is cut ear by ear.

The number of strokes which should be given to obtain the most reliable results is a matter requiring investigation, and one which will depend, moreover, on the purpose of the experiment. Thus if we are estimating probable loss by shattering during handling, a small number of strokes would seem to be best. If, on the other hand, the point at issue is the labour involved in threshing different varieties, natural conditions will be more nearly reproduced by giving sufficient strokes to detach most of the grain. In the trials at Telok Chengai 21 strokes were given in each case, and it was found that this treatment detached 32 to 71 per cent. of the grain. As far as possible ripe but not over-ripe padi was used.

The results from seven varieties of padi were as follows:—

Variety.	Percentage Total Grain Lost.
Mayang Ebus 80	... 71.2
Radin China 17	... 66.0
Siam 29	... 65.9
Mayang Ebus 88	... 65.8
Nachin 10	... 62.9
Rayong 6	... 49.4
Mayang Tekai	... 32.3

It is very difficult to get all factors standardized properly for a determination of this kind, and it is realized that there are many possible criticisms of the method used. Further trials will be necessary before it will be possible to specify threshing characters with confidence, but it is worth recording that the relative position of the varieties as indicated by the figures given in the above table coincides in general with the opinion of cultivators regarding their degree of frangibility.

Received for publication 4th May, 1939.

The Experimental Threshing Machine.

AN OUT-OF-SEASON TRIAL WITH PADI IN CONNEXION WITH THE PERAK RIVER PUMPING SCHEME AT BOTA AND LAMBOR KANAN.

Compiled by J. L. GREIG,
State Agricultural Officer, Selangor.

Introductory.

The *mukims*† of Bota, Laiang-Laiang and Lambor, downstream from the village of Parit on the banks of the Perak River are, for a rural area in British Malaya, densely populated. Although there is in these *mukims* an aggregate of approximately 2,500 acres of padi land, some of it, in a season of sufficient and well distributed rainfall, capable of yielding 400 *gantangs** (2,250 pounds) of padi per acre or even much more in the more fertile parts, the whole area used to be dependent for its water supply on direct rainfall.

The banks of the river are too high to allow of the construction of any simple gravitational irrigation scheme from the river itself, and no streams that can be utilized flow through the area. Hence in a year of capricious rainfall, after much heavy manual labour, padi cultivators were liable to suffer a failure of the crop with its attendant distress, owing to the lack of any form of irrigation.

Observations over some fifteen years have shown that in the majority of seasons droughts and floods have prevented anything but the production of a small crop and it has been the exception when rainfall has been sufficiently well distributed to enable this area to yield the harvest of which its soil makes it capable.

There is a belief amongst many Malays that these lands at one time gave quite good crops of padi in most seasons. It is quite reasonable to suppose that this is true and that the low and uncertain crops of more recent times have been the result of altered conditions, such as change in the levels of the Perak River and its banks.

As long ago as 1912 a scheme was drawn up by the Public Works Department, Perak, whereby it was proposed to pump water from the river. There were also proposals for an alternative scheme providing for a catchment area with a service reservoir to regulate the flow of water. In 1932 the problem was again taken up by the newly created Drainage and Irrigation Department, Straits Settlements and Malay States. On investigation the storage scheme had to be rejected for technical reasons, and as the only other source of supply for these *mukims* was the river, and as the right bank at the particular point where it was desirable to initiate the irrigation supply was about 10 feet high, the original suggestion of pumping was adopted.

† *Mukim* m. = a parish.

* *Gantang* m. = Imperial gallon.

Normally there is only one annual padi season which in this part of the country is from July to January, though it may extend to March in seasons of late rainfall. The young padi plants are transplanted in September, or later if weather is not propitious, and from then until the end of the year occurs the long wet season which may be expected to furnish suitable growing conditions. The aim is to harvest in the dry weather of February and early March, though, in fact, in the areas with which this article is concerned, it was often much later.

In order to solve the problem of supplementing the deficiencies of the rainfall as economically as possible the Drainage and Irrigation Department drew attention to the annual average precipitation graph (Figure I) and suggested taking advantage of the two peaks of rainfall in April and again in November. It was pointed out that a crop grown in an October—May season would get approximately the same amount of rainfall as a crop grown in the normal July—February season.

It was proposed to irrigate the padi lands in Bota and Lambor Kanan *mukims*. The suggestion was to divide this area in half and retain the normal season for the northern half and make the season in the remaining half October to May. This would mean that the maximum water requirements of the two component parts on account of low rainfall would be at different periods. In the northern half the padi would require irrigation water in the comparatively dry July-September period whilst the corresponding period in the southern half would be January-March. The main advantage of this system of partially alternate irrigation from the engineering point of view lies in the fact that a pumping installation of approximately half the capacity and consequently of considerably less capital cost would be able to render the same service as one twice the size supplying the whole area for the normal padi season from July to February.

With this object in view an installation consisting of a Gill Axial flow pump capable of delivering 25 cubic feet of water per second driven by a 68 h.p. Allen Diesel engine was completed early in 1935. The main irrigation channel $11\frac{1}{4}$ miles long and a branch channel $2\frac{3}{4}$ miles long were dug and the supply of water commenced on the 25th June, 1935.

The view of the Department of Agriculture was that, although the normal season padi would be sufficiently tall and strong to withstand serious damage by flooding, which is always liable to occur in the riverine *mukims* in October, November and December, the padi grown in the October-May season would be at such a young stage of growth that it would be much more susceptible to damage by floods. As an alternative it was suggested that a January-July season would hold out more chances of success. Reference to the graph in Figure I shows that there would be two danger periods in such a season. The first would be the short dry season extending from mid-January to mid-March when the area to be planted would have to rely almost entirely on water supplied by the pump to maintain nurseries and facilitate cultivation. The second would be liability to flooding during the short wet season in April, when in some years floods had occurred. Apart from these

Figure 1.

Average monthly rainfall taken over period of 5 years Parit District, Perak.

considerations, the possibility was suggested that the mere supply of moisture by irrigation might not be enough and that for padi to grow well and produce a good crop the atmospheric humidity normal to rainy weather might be necessary.

The proposals for alternate irrigation were considered at a meeting of the Perak Drainage and Irrigation Board held in Taiping on 3rd April 1935. It was agreed that it would be unreasonable to go counter to the prejudices of the local cultivators who had always cultivated padi in a July-March season, and force half of them to cultivate in a January-July season to suit the conveniences of the pumping scheme until the chances of securing a crop at all or a yield equally as good as a normal season crop were known. Even a partially successful crop in the unusual season would create the unsatisfactory position that the cultivators in one half of the area would have to resign themselves to smaller crops if alternate cultivation were enforced. In such an event it would seem more equitable to allow padi over the whole area to be grown in the July-March season, utilizing the available water as far as possible. It was further pointed out at the meeting that observations had indicated that padi planted out of the normal season might have a very much longer maturation period than that usual for the variety when planted in the normal season.

In view of these considerations it was agreed that, as the scheme had been visualized and designed from the start as one of alternate irrigation, the January-July season should be given a trial on an area of about 20 acres, before making any attempt to induce cultivators to adopt this season. Accordingly an area of this size was selected in the *bendang*‡ Pendiat about half a mile from the pumping station. The *Penghulus*¶ of Laiang-Laiang and Bota were approached and, exercising their good offices, persuaded the owners of the area required to allow their land to be taken over by the Department of Agriculture for the purposes of the experiment as soon as their own crops had been harvested.

Details of Experiments.

Season 1936. It was hoped to lay down nurseries towards the end of December 1935, anticipating that the normal season harvest would be completed and the area available to commence cultivation for the out-of-season crop during January. Unfortunately the standing crop had been planted late, harvesting was correspondingly delayed and it was not possible to lay down dry nurseries of padi Radin 11 and Radin 13 until the 11th March. *Menajak*§ was begun on contract on 20th March and occupied approximately three weeks. Transplanting was started on 19th April, when the padi had been in the nursery for 39 days, and was completed by the 5th May.

† *Bendang* m. = a padi field.
¶ *Penghulu* m. = a head man of a mukim.
§ *Menajak* m. = the operation of cutting out-of-season growth in preparing padi fields.

For the first month the general appearance of the padi was satisfactory and growth was normal, but on 6th June larvae of the padi stem borer *Diatraea polychrysa* Meyr. were found to be damaging the stem tissues. A count was made and it was estimated that 8 per cent. of tillers of the Radin 11 and 3 per cent. of the Radin 13 were affected.

During July when normal season cultivators commenced to clear and cultivate neighbouring padi fields there was a large influx of rats into the experimental area which was now about 4 months old from sowing.

The use of poison bait and traps had little effect and to obtain an idea of the yield which might be expected four wire netting cages 11 ft. square were constructed over selected areas. These cages were erected during the first week of September.

By the beginning of October the padi was about 5 months old from planting and there was still practically no sign of flowering, although the normal maturation period of the varieties used is 6 to 6½ months from sowing.

At this stage it was decided to abandon the experiment for the year with the exception of that part of the crop growing in cages. Sufficient labourers were retained to trap rats and keep the cages clear of weeds.

At the end of December only a few heads of grain were harvested from the cages.

Tiller counts were made on three complete plants from the wire netting cages with the results shown below in Table I.

Table I.

Details of Tiller Counts for Padi Plants in 1936.

Cage No.	Variety of Padi.	No. of Tillers	No. of Flowering Tillers	No. of Tillers Setting Grain.
1	Radin 11 ...	15	7	2
		22	16	3
		21	7	1
2	Radin 11 ...	25	18	1
		26	5	0
		26	14	4
3	Radin 13 ...	19	9	2
		23	9	6
		19	13	3
4	Radin 13 ...	23	10	3
		31	8	5
		25	9	4
Means	Radin 11 ...	22.5	11.2	1.8
	Radin 13 ...	23.5	9.7	3.8

The number of flowering tillers taken during a similar count with the same strains at the Padi Test Station, Bruas, situated about 10 miles away, gave the following figures:—

Variety.	Mean No. of Flowering Tillers.
Radin 11	8.8
Radin 13	8.6

These figures are in the same order as those examined in the experiment, but whereas in the latter only a small proportion produced grain, practically all flowering spikes at Bruas Station produced grain.

Season 1937. Of the 20 acres cultivated the previous season, 5 acres lying at the north end of the block were discarded owing to irrigation difficulties.

Nurseries were sown on 11th January 1937 with the following strains of padi:— Siam 29, Radin Siak 34, Radin 11, Radin 13, Reyong 20, and Nachin 756.

All these strains have a normal maturation period of 6 to 6½ months, sowing to harvest.

Transplanting was commenced on 1st February and was completed on the 15th.

In order to ensure that the area would be adequately cared for, a resident labour force of twelve Indian labourers was established. Weeding was carried out regularly and careful measures taken by means of traps and poison baits to keep down rats.

As soon as the padi started to grow it was attacked by stem-borers. The extent and seriousness of the damage is apparent on examining Table II below. As a result the padi could make little progress, the production of new tillers counterbalancing the destruction of old ones.

By the third week of June, eighteen weeks after transplanting, only a very small proportion of plants had flowered and in most cases the grain was empty, the grain bug *Leptocorisa acuta* Thubg. being present in quantity. It was now becoming increasingly apparent that either insect damages or seasonal influence or a combination of both had retarded the growth of the padi to such an extent that little further useful data would be obtained by repeating the experiment in the following year.

At a meeting of the Perak Drainage and Irrigation Board held at Taiping on 21st September 1937 the State Agricultural Officer informed the Board of the unsatisfactory nature of the results. The padi eventually came into ear and a very small harvest was obtained during March 1938 concurrently with the harvest for padi planted in normal season. The padi in this experiment had been 14 months in reaching maturity as compared with 6 to 6½ months normal for the varieties when grown in the usual padi season. All varieties were similarly affected and the average yield was approximately 1,000 lbs. per acre.

Conclusions.

This experiment establishes the fact that, in so far as a number of popular Malayan varieties are concerned, there are serious and probably insurmountable difficulties in the way of successful substitution of a January-July season for the

Table II.
Details of Tiller Counts on Padi Plants in 1937.

(Plants were taken at random from an area of about 20 sq. ft.)

Variety of Padi.	Percentage of Plants Attacked	Average No. of Tillers per plant	Average No. of Bored Tillers per plant	Average No. of Surviving Tillers per plant	Percentage of Bored Tillers
Counts made 25th—30th March 1937.					
Siam 29 ...	100	13.1	6.7	6.4	51.1
Radin 11 ...	96	10.4	3.9	6.5	37.5
Radin 13 ...	98	8.2	3.6	4.6	43.8
Radin Siak 34 ...	10	18.3	0.2	18.1	1.2
Reyong 20 ...	88	8.9	3.1	5.8	34.6
Nachin 756 ...	22	9.9	0.4	9.5	4.0
Mean ...	69	11.6	3.0	8.6	25.6
Counts made 25th—30th April.					
Siam 29 ...	78	9.1	4.3	4.8	47.5
Radin 11 ...	71	7.0	2.6	4.4	36.6
Radin 13 ...	85	9.0	4.3	4.7	47.8
Radin Siak 34 ...	48	21.3	1.8	19.5	8.4
Reyong 20 ...	68	8.7	2.2	6.5	25.4
Nachin 756 ...	65	13.2	2.7	10.5	20.7
Mean ...	69.1	11.4	3.0	8.4	26.2
Counts made 25th—30th May.					
Siam 29 ...	61	25.3	3.3	22.0	13.1
Radin 11 ...	58	15.7	2.3	13.4	14.7
Radin 13 ...	47	13.0	1.7	11.3	12.9
Radin Siak 34 ...	66	28.4	2.6	25.8	9.1
Reyong 20 ...	73	19.4	3.8	15.6	19.4
Nachin 756 ...	94	20.9	4.0	16.9	19.0
Mean ...	66.5	20.4	2.9	17.5	14.7

Table III.

Rainfall Records for Period 1934 to 1938 at Parit, Perak, Federated Malay States.

Month	1934	1935	1936	1937	1938	Monthly Mean
	ins.	ins.	ins.	ins.	ins.	ins.
January ...	10.00	6.23	12.50	7.34	5.63	8.34
February ...	6.21	2.49	1.07	3.69	3.57	3.41
March ...	7.75	5.65	6.45	5.19	5.84	6.18
April ...	7.77	3.92	6.70	21.26	9.97	9.92
May ...	7.62	3.67	4.06	3.66	3.78	4.56
June ...	5.23	2.37	1.46	.54	2.81	2.48
July ...	2.06	3.38	2.28	3.05	3.30	2.81
August ...	7.67	10.00	4.09	4.78	4.98	6.30
September ...	4.91	2.35	7.77	6.10	5.10	5.23
October ...	8.04	10.09	8.49	11.59	8.79	9.40
November ...	12.32	6.34	10.31	7.71	3.80	8.10
December ...	4.76	9.46	13.81	4.34	6.70	7.81

July-March season normal for padi cultivation in the area concerned. As is indicated in the introductory remarks, general observations elsewhere in Malaya had indicated that this might prove to be the case.

The experiment does not provide any data on which to base any definite conclusions as to whether the reasons for the fact established are direct seasonal influence on the growth of the padi plants: whether the seasonal influence is more directly connected with pest incidence: or whether a combination of both is the cause of the much prolonged maturation period exhibited by the varieties grown in the experiment.

Experiments conducted by the Entomological Division of the Department and concerned with investigations of padi stem borer incidence, however, give strong indication that the heavy stem borer attack recorded for the experiment described in this article may have been the main, if not the sole, cause for the prolonged maturation period and consequent delayed fruiting of the varieties of padi used in this experiment.

Summary.

For two seasons an attempt was made to grow padi out of season (*i.e.* January-July), deficiencies in the rainfall being made up by the pumping station at Pendiat, Bota. In neither season was a satisfactory crop harvested.

Heavy damage was done by padi stem-borers (*Diatraea polychrysa* Meyr.), padi bug (*Scotinophara* sp.) and the grain bug (*Leptocorisa acuta* Thubg.), and in the first season by rats.

In the second attempt the padi, although sown during January 1937, did not ripen and come to maturity until March 1938, the general ripening time for normal season crop in the district, a period of 14 months from the date of sowing.

Whether this was caused by direct seasonal influences on plant growth, by seasonal influences on pest incidence, or by a combination of both, is outside the scope of this experiment. Other experiments concerned with investigations into stem borer incidence, however, provide strong indications that seasonal pest incidence may be the main, if not the sole, cause.

The information in this article has been compiled mainly from reports by officers of the Drainage and Irrigation Department and of the Department of Agriculture in Perak, Federated Malay States.

QUARTERLY REPORT ON THE MALAYAN PINEAPPLE CANNING INDUSTRY.

March to May, 1939.

Prepared by the Economics Branch of the Department of Agriculture, S.S. & F.M.S., from Reports of Field Officers.

Factories.

The total number of registered factories is fifteen, as compared with sixteen for the previous quarter. Nine factories started operating during the early part of the main pineapple season which began in April; five of these were in Johore, three in Singapore, and one in Selangor. The other six registered factories were not working as a result of the quota restriction scheme operated by the Central Board. If all the sixteen factories worked to pack their allotted quota, which in every case is below their maximum output, the cost of production would be increased, owing to the resulting higher overhead costs. In practice, the canners have agreed to buy and sell their quotas among themselves in such a way that the factories required are kept operating at full capacity, thus reducing overhead and consequently production costs. The idle factories are being maintained ready for immediate use in case any of the working factories should for any reason have to cease production.

Production and Sales.

The production quota fixed by the Central Board for the short season ending March 31st, 1939, was 850,000 cases. Owing to a briskening demand, the Central Board had to revise this quota to allow an actual production of 1,030,726 cases.

The quota for the main season extending from April 1st to September 31st, 1939, was fixed in advance at 1,000,185 cases. April reports indicated that a large proportion of the main season's pack was being sold in advance, and that the demand for the Golden Grade (or first quality) pack was particularly keen, all stocks of this grade having been sold out.

Total exports of canned pineapples from this country for the four months ending April 30th, 1939, amounted to 28,263 tons, valued at $3,131,646. The January and February exports were given in the last report, while those for March and April amounted to 7,616 and 9,277 tons respectively.

Prices and Stocks.

The Central Board made an increase in price of 15 cents per case on all grades of pineapples, the price per case thus being increased from $3.10 to $3.25 for 1½ lbs. Standard Cubes, and from $3.50 to $3.65 in the case of the Golden Grade for the same type of pack.

Quotations in Singapore in Straits dollars per case of 48 cans of 1½ lbs. each during the three months under review, were as follows:—

1939	General Average Quality (G.A.Q.)			Golden		
	Sliced Flat	Sliced Tall	Cubes	Sliced Flat	Sliced Tall	Cubes
March ...	3.05	3.20	3.10	3.45	3.60	3.50
April ...	3.05	3.20	3.10	3.45	3.60	3.50
May ...	3.20	3.35	3.25	3.60	3.75	3.65

Fresh fruit prices paid to growers tended to rise slightly during the above period. Prices per 100 of fresh fruit ranged from 90 cents to $1.70 in Singapore, from 50 cents to $2.20 in South Johore, and from 50 to 80 cents in Selangor, depending on quality. Selangor prices appear to be too low and an investigation into the functioning of the regulations governing the Central Board, which are in part framed to regulate growers' prices in direct ratio to the prices obtained per case of G.A.Q. cubes, has been instituted by the Department of Agriculture.

Stocks of canned fruit on hand in Singapore at the end of May were estimated at 472,000 cases.

Government Research Station and Canning Factory.

A small demonstration canning factory, situated at Johore Bahru and equipped by Government with the latest types of canning machinery, started operating during the quarter. It is under the control of the Canning Officer, Department of Agriculture, S.S. & F.M.S., who reports that demonstration runs were carried out for the benefit of packers, and that considerable interest was taken in the new types of machines not previously seen in this country. Numerous enquiries were received from packers who are interested in installing similar equipment in their own factories.

General.

Singapore has enjoyed a very good fruit season during the period under review, high-quality supplies being plentiful.

The Central Board of Pineapple Packers, Malaya, was gazetted on May 12th, 1939, in the Straits Settlements, as being the officially-recognized packers' association. The Board has continued to function smoothly.

No new planting has been reported during the quarter. Reports from Selangor indicate that in one district small-holders are cutting out the pines from certain areas in which they had been interplanted among coconuts, due chiefly to the approaching maturity of the main crop and to the diminished size of fruit being obtained from the old pineapple intercrop.

Abstract.

RICE RESEARCH.*

This progress report of 22 pages deals with quality in milled rice and the effect thereon of polishing, parboiling, storage and manuring, and contains a miscellany of interesting observations.

Dr. Sreenivasan points out that comparison of specimens of raw and parboiled rices milled to different degrees shows that, with a limited amount of milling, parboiled rice does not lose as much nitrogen or phosphorus as raw rice. With increased milling, however, the difference tends steadily to diminish, until beyond the half-milled condition more nitrogen and phosphorus are removed with the polishings of parboiled than of raw rice, so that in a fully polished condition there is little difference in composition between the two types.

The reason for this difference in the rate of removal of nitrogen and phosphorus is, apparently, that the process of parboiling causes an inward diffusion of these constituents so that the higher concentrations which occur in the outer layers of the bran of raw rice, are found further inwards in the bran layers after parboiling. There is also diffusion of nitrogen and phosphorus from the bran layers into the starchy endosperm.

The results of analyses of commercial samples of rice show, however, that parboiled rice is somewhat richer in proteins and minerals than ordinary white rice. The reasons given for this are that since parboiling produces a coloured product even after polishing, and as the parboiled grain begins to break up if polishing is extended beyond a certain stage, it is not generally polished to the same extent as raw rice.

In addition to the above reasons there is the fact that usually the coarser and coloured varieties of rice are used for parboiling. These have thick bran layers and contain more nitrogen and phosphorus than the so-called "superior" varieties.

It is concluded, therefore, that the generally higher nutritive value of parboiled rice is due to its being usually consumed in an undermilled state, and to the fact that less of the nutritive constituents are lost by the ordinary process of washing and cooking.

The fat and proteins of rice bran have a definite, though small, inhibiting action on the activity of digestive ferments.

It is stated that whole grains of cooked parboiled rice digest more slowly than those of cooked raw rice and require better mastication; but parboiling results in partial dextrinization of the rice starch so that under ordinary conditions, where proper penetration of the enzymes is ensured, such rice is more easily digested than raw rice.

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* Abstract of a bulletin entitled "Progress Report on the Scheme of Research on Quality in Crops with Special Reference to Rice, during the period December 1934 to November 1937." by A. Sreenivasan, M.A., D.SC., Department of Biochemistry, Indian Institute of Science, Bangalore.

Unpolished rice is slow to cook, but this and its digestibility and food value vary with the variety. Polished rice is more easily digested than unpolished rice, but the digestibility of half-polished rice may be better than that of highly polished rice. Much work, however, is still necessary to obtain a correct indication of the digestibility of unmilled or undermilled rice.

Samples of three different varieties of rice were stored as padi, and results showed that the cooking quality of the rice improved under good conditions of storage. Well-stored rice grains swell on cooking to about four times the original volume and the cooked grains remain detached from one another; while rice from freshly harvested padi scarcely swells to twice its original volume and cooks to a pasty condition which prevents digestive ferments from coming into further contact with the mass. Trials have shown that well-swollen and detached grains are easily penetrated by the digestive enzymes.

Hulled, unpolished rice cannot be kept for more than a month and deteriorates rapidly during storage, owing to the decomposition of the oil or fat in the pericarp or bran layers in contact with the moist atmosphere. The factors contributing to improved keeping quality in unpolished rice are being studied. Desiccation with air-tight storage has been successful.

The chemical composition of rice is greatly influenced by several factors such as type of soil, climatic conditions, seasonal variation and by manurial treatments. There is considerable variation in composition of different varieties.

The colour of parboiled rice may be improved considerably by reducing the time of steeping and parboiling. The use of certain chemicals in the steep water also lightens the colour of the grain. Recently, a process has been patented by which a light-coloured product can be obtained by heating the steeped grain for very short periods at over 400°C.

R. B. J.

Review.

Plant Injection for Diagnostic and Curative Purposes.

By W. A. Roach, (Foreword by Prof. V. H. Blackman Sc.D., F.R.S.). Technical Communication 10 of the Imperial Bureau of Horticulture and Plantation Crops, East Malling, Kent, England, 1938, pp. 78, plates 2, text figures 47, bibl. 162, price 5 shillings.

Man has toyed for centuries with the idea of feeding his fruit trees direct instead of by more orthodox but slower methods and in the heyday of the Italian Renaissance we find Leonardo da Vinci noting that if it is desired to produce poisoned fruit the injection of fruit trees offers a way.

More recently various "tree doctors" have suggested that easy rejuvenation of orchards can be effected by the use of their own particular injection methods, but such methods have always been somewhat suspect, since obviously different conditions demand different remedies and the cure may prove worse than the disease.

It has remained for Dr. Roach to bring order out of chaos and show those of us who are attracted by the idea how to set about our investigations.

He starts by giving a history of injection work in Europe and the U.S.A., paying particular attention to that published in recent years on the detection and cure of deficiency diseases. He notes also the successful use of injection for purely physiological purposes, as, for instance, of glucose into vines, just before bud break to ensure a good fruit set. He points out, moreover, how injection methods may be of great value in the study, not only of mineral deficiencies, but also of rootstock influence and of the effect of the chemical constituents of a fruit on its storage capacity.

Recent cases of successful injection cited include the following:—diagnosis of incipient chlorosis of the iron shortage type at East Malling; diagnosis and cure of a copper deficiency dieback disease in apples in Western Australia; determination of the cause and cure of boron deficiency diseases of apples in Canada and New Zealand; increase in vigour and freedom from insect pests in apple trees injected with solutions of various chemical solutions in England.

His own experiments have been in progress for seven years on material which has ranged from the strawberry plant to fully grown apple and plum trees, and most of the present paper is devoted to a consideration of the methods used. It is for this clear and illustrated account that horticulturists will be particularly grateful. He describes in detail, with the help of text figures and lists of tools, the technique used for the injection of particular parts of standing trees and other plants, varying in size from a single interveinal area of a leaf to whole main branches, noting, moreover, the type of problem for which each particular method is best suited. He shows how, in the most delicate methods, the injection of leaves and their comparison with neighbouring untreated leaves or parts of leaves enables a rapid diagnosis to be

made of the mineral deficiency from which a plant or tree is suffering. He describes how whole trees may be injected for experimental purposes or even for economic reasons in the commercial orchard.

In short he shows how the operations advocated may be carried out and how to avoid those many pitfalls which await the over-zealous, although he is far from suggesting that all his methods are perfect.

Departmental.

FROM THE DISTRICTS.

Compiled by the Chief Field Officer from Monthly Reports of Agricultural Officers.

June, 1939.

The Weather.

Over most of the Peninsula weather during June was normal for the time of year: hot and dry, with a low rainfall. In Penang conditions continued to be abnormal. In May there was very heavy rain and floods; in June the total rainfall was again above average.

In north Pahang precipitation was well above average, frequent heavy showers occurred and the weather was cool and similar to that experienced in a normal wet season month.

Crop Reports.

Rubber.—Prices generally remained unchanged, though local conditions caused prices to harden slightly in some districts; thus in Ulu Langat, Selangor, many tappers have been engaged in rice cultivation, and the resulting reduction in production of rubber caused prices in that District to increase.

In the Selangor coastal districts there has been an increase in tapping anticipating the approach of the coupon issue for the third quarter.

The price difference between smoked and unsmoked rubber is now so small that cabinets are generally not used.

In Kelantan conditions in this respect are more satisfactory. There the price difference between smoked and unsmoked sheet (F.A.Q.) is from $2 to $3 per picul. In the Kota Bharu District twelve of these smoke houses are at present in existence, four are under construction and sixteen await construction, while in the Kampong Machang district the numbers are 14, 5 and 4 respectively. Capacities range from 4 to 60 piculs. Many of these smoke houses now in operation, under construction or mooted, are on co-operative lines.

Padi.—In Kedah, cultivation has commenced under favourable conditions. Likewise in Perak, Penang and Province Wellesley water supplies are ample and cultivation is in full swing. In the Sungei Acheh area, Province Wellesley, there has been some difficulty in getting cultivators to start work on the dates fixed, though conditions were ideal.

Lack of rain in Malacca has held up cultivation, and water supplies were so short in some areas that by the end of the month it had not been possible to make a start.

The prohibition of export of padi and rice from Kedah has been followed by a fall in price in that State. Several rice mills have temporarily suspended production.

In Krian the price of padi in the field has dropped slightly. The Government Rice Mills have stopped buying. There is in any case little padi left in the hands of dealers or cultivators.

Up to the 16th June the Government Rice Mills had bought 283,000 piculs of padi (approximately 46 per cent. of the total crop), and 35,000 piculs (6 per cent.) had passed through the Customs gates into Province Wellesley.

The sealing of Seraup 48 has now finished. Approximately 195,000 bags of S.48 (69 per cent.) of the Krian padi bought by the mills and 31 per cent. of the total crop) obtained the bonus. As the mills wished to buy as much padi as possible considerable latitude had to be allowed in the quality of the padi that received the bonus but all was of good grain type containing a high proportion of Seraup not differing in its milling qualities from a pure sample of S.48.

During the last nine months 21 applications to erect small rice mills in Krian have been received; ten of these mills have been put up and are now working and several more are under construction.

Livestock.

It will be remembered that during 1938 in Kelantan large numbers of cattle were wiped out by an outbreak of disease. The Kelantan Government is now arranging to restock the worst affected areas. A sum of $9,000 has been voted and loans will be made to those who lost their animals in this epidemic to enable them to buy sufficient animals to carry out this season's ploughing. Applications have been received from nearly 200 cultivators. Upwards of 700 acres of padi land are affected.

Penang "Hill Lands".

The new Agricultural Assistant, Hill Lands, started work at the beginning of June. During the rains of the last two months erosion has taken place on tapioca, yam and ginger holdings. Four hill guards have been appointed by the Land Office, whose duty it is to report any new land which they find being opened up.

Tours of the Rural Lecture Caravan.

The Caravan toured Penang and Province Wellesley from June 7th to 26th. Quite good attendances were reported at most centres. The subject of soil erosion was given special prominence. A visit to Ayer Itam was particularly successful: a crowd of 3,000 to 4,000 Chinese, mostly concerned in hill land cultivation listened intently to a lecture by the Chinese Agricultural Assistant on soil erosion on Penang Hill.

Agricultural Instruction.

During June two instructional courses were held for Kedah school boys of Standard VI and VII: the former attended a course on padi planting held at Telok Chengai Experiment Station, which lasted for 7 days; the latter, a course on general agriculture at Gajah Mati Agricultural Station, which lasted for 15 days.

Sixteen boys attended the first course and 11 boys attended the second. They were accommodated at the respective Stations for the duration of the courses In each case one lecture was given by the Principal Agricultural Officer and the remainder by the Assistant Agricultural Officer-in-charge. The course at Telok Chengai included lectures and practical instruction in cultivation, preparation of nurseries, sowing and water control; that at Gajah Mati included lectures on cover crops, green manure, maize cultivation and gambier. In the latter course the boys were able to harvest sweet potatoes and gourds which they had planted during an earlier visit, and were also able to see the results of their efforts at budding.

DEPARTMENTAL NOTES.

Leave.

Mr. J. N. Milsum, State Agricultural Officer, Perak, returned from leave on the 8th June. Mr. J. W. Jolly, Acting State Agricultural Officer, Perak, has assumed duty in the post of State Agricultural Officer, Negri Sembilan.

Mr. V. Dawson, Vice-Principal, School of Agriculture, Malaya, returned from leave on the 8th June and assumed acting duty in the post of Agricultural Economist. Mr. H. L. Barnett, Acting Agricultural Economist, has resumed duty in his substantive post of Assistant to the Agricultural Economist.

Mr. J. Cook, Agricultural Officer, returned from leave on 29th June, and has been posted to the Central Experiment Station, Serdang.

Mr. R. P. Davidson, State Agricultural Officer, Negri Sembilan, has been granted 248 days leave from 30th June 1939 to 3rd March 1940 inclusive.

FERTILIZER PRICES, JULY, 1939.

The following are the prices current for the month of July, 1939, of some of the more important fertilizers.

Product.	Analysis				Price per ton $
	Nitrogen (N)	Phosphoric Acid (P_2O_5)		Potash (K_2O)	
		Soluble	Insoluble		
Sulphate of Ammonia ...	20.6	—	—	—	72.75
Calcium Cyanamide ...	20.6	—	—	—	80.00
Muriate of Potash ...	—	—	—	50	112.00
Sulphate of Potash ...	—	—	—	48	112.00
Superphosphate (concentrated) ...	—	39	—	—	105.00
Superphosphate ...	—	16-18	—	—	60.00
Basic Slag ...	—	—	16	—	48.00
Rock Phosphate (Christmas Island) ...	—	11*	38‡	—	33.50
Rock Phosphate (very finely ground Gafsa) ...	—	11*	26 - 28‡	—	40.00
Lime ...	—	—	—	—	20.00

* Citric soluble. ‡ Total

Quotations are *ex* warehouse, Port Swettenham, Klang, Singapore and Penang, with the exception of muriate of potash which is *ex* warehouse, Port Swettenham, Klang and Singapore.

The above quotations for concentrated superphosphate, superphosphate and Christmas Island phosphate are *ex* warehouse Penang, Port Swettenham and Klang. The Singapore quotations for these three fertilizers are $95, $50 and $31.50 per ton respectively.

Statistical.

MARKET PRICES.

June 1939.

Major Crops.

Rubber.—Prices were maintained at a higher level during June but weakened slightly in the second half of the month. No. 1. X. Ribbed Smoked Sheet, loose, opened in Singapore at 28⅞ cents per lb., improved to 29 cents on the 10th June, and closed at 28 cents. The average of daily quotations for the month was 28.53 cents per lb., as compared with 27.88 cents in May. The London average price was 8.24 pence and New York 16.31 cents gold, as compared with 8 pence and 15.95 cents gold in May.

Prices paid for small-holders' rubber at three centres during the month are given in Table I.

Table I.

Weekly Prices Paid by Local Dealers for Small-Holders' Rubber, June, 1939.

(Dollars per picul of 133 1/3 lbs.)

Grades	Kuala Kangsar, Perak			Kuala Pilah, Negri Sembilan					Batu Pahat, Johore.			
	7	14	28	1	8	15	22	29	7	14	21	28
Smoked Sheet ...	36.00	35.50	35.13	36.10	35.50	35.00	34.80	35.00	—	34.90	34.10	—
Unsmoked Sheet ...	—	—	33.00	—	—	—	—	—	34.42	33.70	34.25	33.97
Scrap ...	No purchases											

Transport by F.M.S.R. lorry service Kuala Pilah to Seremban 12 cents per picul, to Malacca excluding duty, 25 cents per picul, by rail Seremban to Penang $1.24 per picul, Seremban to Singapore $8.00 per ton.

Transport from Batu Pahat to Singapore by lorry excluding duty, 90 cents per picul.

Transport from Kuala Kangsar to Prai by railway $6.20 per ton.

Transport from Kuala Kangsar to Singapore by railway $10.00 per ton (minimum consignment 5 tons).

At Kuala Pilah the standard deduction for moisture in unsmoked sheet is 5 per cent.

No purchases of rubber at Kuala Kangsar on the 21st June.

Palm Oil.—Prices were maintained at a slightly higher level during June, but weakened at the close. Table II gives the month's quotations. The averages of the May quotations were:—palm oil £13.2.6, kernels £8.18.2.

Table II.

Prices of Palm Oil and Palm Kernels.

Date 1939.	Palm Oil in Bulk, c.i.f. landed weight Liverpool/ Halifax.	Palm Kernels, c.i.f. landed weight London/ Continent
	per ton	per ton
June 2	£ 13. 10. 0 Canada	£ 9. 0. 0 Hamburg
,, 9	13. 10. 0 ,,	9. 0. 0 Rotterdam
,, 16	13. 10. 0 (nominal)	9. 0. 0 Hamburg
,, 30	13. 0. 0 ,,	8. 7. 6
Average	£ 13. 7. 6	£ 8. 16. 11

Copra.—The Singapore market fluctuated somewhat during June. The sun-dried grade opened at $3.85 per picul and improved to $3.90 on the 7th June; it then fell to $3.60 on the 17th, and closed at $3.75. The Singapore average price for the month was $3.74 per picul, and $3.41 for the mixed grade. The May averages were $3.75 and $3.45 respectively.

Copra cake remained unchanged at $1.60 per picul.

Rice.—The Singapore average wholesale prices of rice per picul in May were as follows:—Siam No. 2 Ordinary $3.81, Rangoon No. 1 $3.47, Saigon No. 1 $3.22, as compared with $3.71, $3.17 and $3.42 in April, and with $4.16, $3.90 and $3.92 in May 1938.

The average retail prices in cents per gantang (gallon) of No. 2 Siam rice were: Singapore 27, Penang 32, Malacca 28, as compared with 26, 32 and 28 respectively in April.

The average declared trade value of imports during May was $3.76 per picul, as compared with $3.72 in April and $3.76 in March.

Padi.—Prices of padi per 100 gantangs (gallons) ranged from $8 to $12 in most parts of the country. In Mersing, Johore, the price range was $9 to $10, but in other parts of the State was $12 to $14. In Kedah the range was $7.50 to $7.70.

The Government Rice Mills, Perak, paid $2.20, rising to $2.30 per picul for padi, and the Temerloh Rice Mill, Pahang, paid $2.20.

Pineapples.—Prices remained unchanged at the new levels fixed by the Central Board of Packers in May. Prices, per case of 48 cans of 1½ lbs. each, were:—G.A.Q.: Sliced Flat $3.20, Sliced Tall $3.35, Cubes $3.25; Golden: $3.60, $3.75 and $3.65 respectively.

Fresh fruit prices per 100 were as follows:—Singapore 50 cents to $1.80; Selangor 50 to 80 cents; Johore, 1st quality $1 to $1.30, 2nd quality 85 cents to $1, 3rd quality 55 to 80 cents.

Beverages.

Tea.—Two consignments of Malayan highland tea, comprising 148 packages, were sold on the London market during June at 1s.3¼d. and 1s.3¾d. per lb., the average price being 1s.3½d. Seven consignments of lowland tea, comprising 426 packages were sold in London at prices ranging from 11¼d. to 1s.1½d. per lb., the average price being 1s.0.29d.

The average London prices per lb. realized for tea from other countries, according to the *Tea Market Reports* for June of the Tea Brokers' Association of London, were as follows:—Ceylon 1s.3.05d., Java 1s.0.67d., Indian Northern 1s.1.99d., Indian Southern 1s.2.23d., Sumatra 11.08d.

The latest Colombo prices available, quoted from *The Ceylon Tea Market Report* of 27th June, 1939, of the Colombo Brokers' Association, are as follows, in rupee cents per lb.:—High Grown Teas 76, Medium Grown Teas 69, Low Grown Teas 66.

Coffee.—Liberian coffee improved from $14.50 to $14.75 per picul. Excelsa was quoted at $10.50 throughout the month, weakening to $10.25 at the close. Robusta was unchanged throughout the month at $6.75 per picul.

The average of highest and lowest quotations in Singapore for Palembang coffee was $11.22 to $13.30 per picul, and for Sourabaya coffee $9.43 to $11.27, the price within these ranges depending upon quality.

Spices.

Arecanuts.—Prices fluctuated considerably during June. The averages of the Singapore Chamber of Commerce quotations per picul were:—Best $5.94, Medium $5.51, Mixed $5.04.

The averages of the highest and lowest quotations per picul in Singapore were as follows:—Splits $4.48 to $6.67; Red Whole $5.10 to $6.75; Sliced $8.76 to $11.93, as compared with $4.50 to $6.65; $5.19 to $6.69; and $7.62 to $9.62 in May.

Pepper.—Prices fell during June, and the monthly averages per picul were:—Singapore Black $7.44, Singapore White $11.62, Muntok White $11.88. The May average prices were $8, $12.44 and $12.69 respectively.

Nutmegs.—There was no change in this market; 110's and 80's were both quoted at $28 per picul. Penang dried nutmegs were sold at $19 per picul.

Mace.—Prices remained unchanged. Siouw $85 per picul (nominal), Amboina $58. Locally produced mace, dry, was sold in Penang at $70 per picul.

Cloves.—Nominal quotations in Singapore remained unchanged at $40 per picul for both Zanzibar and Amboina. Penang cloves, dried, sold in Penang at $45 per picul.

Cardamoms.—Green cardamoms were quoted in *The Ceylon Chamber of Commerce Weekly Report* for 26th June, 1939, from Rs. 1.15 to Rs. 1.27 per lb.

Miscellaneous.

Derris.—There was no change in Singapore prices of derris during June. Roots sold on a basis of ether extract were $7.50 to $9 per picul, and roots sold on rotenone content were $17.50 to $18.50.

Gambier.—Prices remained unchanged: Block $8 per picul nominal, and No. 1 Cube $17.

Sago.—Prices fell during June. Pearl averaged $4.10 per picul, and Flour, Sarawak Fair, averaged $2.42, as compared with $4.28 and $2.54 respectively in May.

Tapioca.—With the exception of Pearl Medium, prices fell during June. Flake Fair averaged $4.10 per picul; Seed Pearl averaged $4.85, and Medium Pearl was quoted throughout the month at $5. The May average prices were $4.18, $4.81 and $4.94 respectively.

Tobacco.—Kelantan prices for prepared tobacco were high during June: 1st quality $100 to $160, 2nd quality $75 to $128, 3rd quality $45 to $112 per picul. In Malacca prices ranged from $16 to $20, and in Johore from $10 to $65. The general range elsewhere was: 1st quality $16 to $28, 2nd quality $10 to $20, 3rd quality $5 to $13. In Kedah the range was $40, $25 and $17.

The above prices are based on London and Singapore daily quotations for rubber, on the Singapore daily prices for copra, on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports and certain coffee prices are kindly supplied by Guthrie & Co. Ltd., Kuala Lumpur, the Singapore prices of imported coffee and arecanuts by Lianqui Trading Company of Singapore, and Singapore derris prices by Hooglandt & Co., Singapore.

1 picul = 133 1/3 lbs. The dollar is fixed at two shillings and four pence.

Note.— The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57, Trafalgar Square, London, W.C.2.

GENERAL RICE SUMMARY*

May, 1939.

Malaya.—Imports of foreign rice during May were 82,318 tons,† and exports 13,263 tons. Net imports were accordingly 69,055 tons, as compared with 46,425 tons in 1938.*

Of the May imports 43 per cent. were consigned to Singapore, 17 per cent. to Penang, 8 per cent. to Malacca, 25 per cent. to the Federated Malay States, and 7 per cent. to the Unfederated Malay States. The foreign imports by countries of origin were as follows (in tons, percentages in brackets):—Siam 53,025 (64.4), Burma 25,019 (30.4), French Indo-China 3,106 (3.8), other countries 1,168 (1.4).

Of the exports during May 73 per cent. were consigned to the Netherlands Indies and 27 per cent. to other countries. The various kinds of rice exported were as follows (in tons, percentages in brackets):—Siam 10,696 (80.6), Burma 1,790 (13.5), French Indo-China 657 (5.0), parboiled 40 (0.3), Malayan production 80 (0.6).

May net imports by countries of origin were (in tons, percentages in brackets):—Siam 42,329 (61.3), Burma 23,229 (33.6), French Indo-China 2,449 (3.6), elsewhere 1,048 (1.5).

India.—Foreign exports during January to April were 110,000 tons, as compared with 98,000 in 1938, an increase of 12.2 per cent. Of these exports 3.6 (4.1) per cent. were to the United Kingdom, 1.8 (8.1) per cent. to the Continent of Europe, 30.0 (33.7) per cent. to Ceylon, 3.7 (5.1) per cent. to the Straits Settlements and the Far East, and 60.9 (49.0) per cent. to other countries. The percentages in brackets are for the corresponding period in 1938.

Burma.—Foreign exports from the 1st January to 24th May totalled 2,015,545 tons, as compared with 1,689,252 in 1938, an increase of 19.3 per cent. Of these exports 57.4 (41.7) per cent. were to India, 6.1 (9.3) per cent. to the United Kingdom, 8.5 (7.7) per cent. to the Continent of Europe, 8.4 (10.4) per cent. to Ceylon, 8.4 (14.0) per cent. to the Straits Settlements and the Far East, and 11.2 (16.9) per cent. to other countries. The percentages in brackets are for the corresponding period of 1938.

Average May prices of rice in rupees per 100 baskets of 75 lbs. each at Rangoon were:—Big Mills Specials 229, Small Mills Specials 234.

Siam.—Exports of rice and rice products from Bangkok during January to April were 540,333 tons, as compared with 565,521 tons in 1938.

Japan.—The supply and demand of rice for the period 1st May to 30th October, 1939, are estimated as follows:—

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* Abridged from the Rice Summary for May 1939 compiled by the Department of Statistics, Straits Settlements and Federated Malay States.

¶ Ton = long ton (2,240 lbs.).

† It is to be understood throughout the summary that all comparisons and percentage increases or decreases are in relation to the corresponding period of 1938.

		tons
Supply:—		
Stocks on 1st May		5,103,000
Estimated imports from foreign countries ...		15,000
Estimated imports from Korea		491,000
Estimated imports from Formosa		435,000
Total ...		6,044,000
Demand:—		
Estimated consumption		4,818,000
Estimated exports		42,000
Total ...		4,860,000
Surplus		1,184,000

French Indo-China.—Entries of padi into Cholon during 1st January to 31st May totalled 1,005,090 tons, as compared with 615,712 tons in 1938, an increase of 63.2 per cent. Exports of rice during the same period were 927,520 tons, as compared with 581,970 tons in 1938, an increase of 59.4 per cent.

Prices of rice in Saigon rose during April from $2.77 to $2.93 per picul. Padi prices improved from $1.78 to $1.89 per picul.

The Netherlands Indies.—The latest information available was published in the March Summary.

Ceylon.—Imports during January to May totalled 253,234 tons, as compared with 237,229 tons in 1938, an increase of 6.7 per cent. Of these imports 15.0 (16.3) per cent. were from British India, 64.3 (72.1) per cent. from Burma, 0.4 (0.4) per cent. from the Straits Settlements, and 20.3 (11.2) per cent. from other countries. The 1938 percentages are in brackets.

Europe and America.—Shipments from the East to Europe from the 1st January to 12th May totalled 678,871 tons, as compared with 458,625 tons in 1938, an increase of 48 per cent. Of these shipments 42.9 (61.3) per cent. were from Burma, 45.3 (24.9) per cent. from Saigon, 10.8 (11.1) per cent. from Siam, and 1.0 (2.7) per cent. from Bengal. The 1938 percentages are in brackets.

Shipments for the Levant from 1st January to 12th May totalled 11,728 tons, as compared with 15,762 tons in 1938, a decrease of 25.6 per cent. Shipments for Cuba, West Indies and America from 1st January to 11th May were 87,097 tons, as compared with 81,703 tons in 1938, an increase of 6.6 per cent.

MALAYAN AGRICULTURAL EXPORTS, APRIL, 1939.

PRODUCT.	Net Exports in Tons				
	Year 1938	Jan./April 1938	Jan./April 1939	April 1938	April 1939
Arecanuts ...	33,769	13,977	14,382	2,646	3,794
Coconuts fresh†‡ ...	116,743†	30,183†	34,454†	7,438†	9,592†
Coconut oil‡ ...	49,140	14,515	17,520	3,010	4,527
Copra‡ ...	68,754	12,442	6,748	2,302	3,041
Copra cake ...	7,112	2,088	2,377	485	523
Gambier, all kinds ...	1,632	509	583	84	122
Palm kernels ...	9,359	2,785	3,369	609	545
Palm oil ...	54,377	16,515	15,980	3,565	3,902
Pineapples, canned ...	73,168	26,908	28,263	6,697	9,277
Rubber¶ ...	360,898¶	135,968¶	106,457¶	27,603¶	27,695¶
Sago,—flour ...	4,537	2,132	2,622	388*	306
,, —pearl ...	4,203	1,375	1,183	413	387
,, —raw ...	5,088*	2,332*	1,493*	622*	605*
Tapioca,—flake ...	981	320	335	74	83
,, —flour ...	3,072*	1,262*	1,087*	404*	233*
,, —pearl ...	17,818	5,232	5,185	1,162	1,601
Derris (tuba root) ...	676	131	431	51	73
‡Copra equivalent ...	150,944	36,632	35,908	7,342	10,589

† hundreds in number. * net imports. ¶ production.

MALAYAN PRODUCTION OF PALM OIL AND KERNELS

(In long tons, as declared by Estates).

Month 1939	Palm Oil			Palm Kernels		
	F.M.S.	U.M.S.	Malaya	F.M.S.	U.M.S.	Malaya
January ...	2,402.5	2,726.3	5,128.8	429.7	502.0	931.7
February ...	2,193.4	1,693.3	3,886.7	372.9	282.0	654.9
March ...	2,453.1	2,324.8	4,777.9	437.9	394.0	831.9
April ...	2,160.5*	2,082.2	4,242.7*	423.4	346.0	769.4
May ...	2,066.0	1,760.1	3,826.1	403.1	274.1	677.2
Total ...	11,275.5	10,586.7	21,862.2	2,067.0	1,798.1	3,865.1
Total January to May, 1938 ...	10,097.1	7,212.7	17,309.8	1,829.3	1,313.0	3,142.3
Total for the year 1938 ...	28,979.0	22,087.7	51,066.7	5,158.9	3,620.0	8,778.9

* Revised figure.
Stocks on estates as at 31st May, 1939, were: palm oil 5,230 tons, palm kernels 712 tons.

ACREAGES OF TAPPABLE RUBBER ACTUALLY TAPPED AND NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING 31SH MAY, 1939.

STATE OR TERRITORY	Estimated Acreages of Tappable Rubber (9)+(11)	ACREAGES OF TAPPABLE RUBBER NOT TAPPED				Area of tappable rubber never been tapped (b)		Total area not tapped (3) + (5) (c)		TOTAL AREA TAPPED DURING THE MONTH		Area of tappable rubber rested under rotational systems (c)	
		On estates which have entirely ceased tapping		On estates which have partly ceased tapping (a)									
		Acreage	Percentage of (3) to (2)	Acreage	Percentage of (5) to (2)	Acreage	Percentage of (7) to (2)	Acreage	Percentage of (9) to (2)	Average	Percentage of (11) to (2)	Acreage	Percentage of (13) to (2)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
S. S.—													
Province Wellesley ...	43,127	1,411	3.3	15,846	36.7	523	1.2	17,257	40.0	25,870	60.0	7,413	17.2
Malacca ...	120,256	5,636	4.7	38,116	31.7	2,159	1.8	43,752	36.4	76,504	63.6	24,249	20.2
Penang ...	2,479	nil	nil	1,204	48.6	9	0.4	1,204	48.6	1,275	51.4	60	2.4
Singapore ...	32,007	5,867	18.4	9,770	30.5	175	0.5	15,637	48.9	16,370	51.1	3,464	10.8
Total S.S. ...	197,869	12,914	6.5	64,936	32.8	2,866	1.4	77,850	39.3	120,019	60.7	35,186	17.8
F. M. S.—													
Perak ...	285,391	10,931	3.8	78,390	27.5	8,112	2.8	89,321	31.3	196,070	68.7	48,437	17.0
Selangor ...	317,904	11,876	3.7	74,851	23.6	7,457	2.3	86,727	27.3	231,177	72.7	54,097	17.0
Negri Sembilan ...	264,228	13,025	4.9	78,082	29.6	14,970	5.7	91,107	34.5	173,121	65.5	45,002	17.0
Pahang ...	85,677	4,619	5.4	29,224	34.1	5,784	6.8	33,843	39.5	51,834	60.5	9,509	11.1
Total F.M.S. ...	953,200	40,451	4.3	260,547	27.3	36,323	3.8	300,998	31.6	652,202	68.4	157,045	16.5
U. M. S.—													
Johore ...	481,367	23,748	4.9	143,137	29.8	37,810	7.9	166,885	34.7	314,482	65.3	71,772	14.9
Kedah ...	197,833	9,639	4.9	34,493	17.4	7,062	3.6	44,132	22.3	153,701	77.7	43,922	22.2
Kelantan ...	31,205	403	1.3	7,396	23.7	2,415	7.7	7,799	25.0	23,406	75.0	5,561	17.8
Trengganu (d) ...	4,817	nil	nil	49	1.0	nil	nil	49	1.0	4,768	99.0	1,651	34.3
Perlis (e) ...	1,459	458	31.4	239	16.4	155	10.6	697	47.8	762	52.2	294	20.2
Brunei ...	5,913	nil	nil	2,098	35.5	313	5.3	2,098	35.5	3,815	64.5	1,378	23.3
Total U.M.S. ...	722,594	34,248	4.8	187,412	25.9	47,755	6.6	221,660	30.7	500,934	69.3	124,578	17.2
Total MALAYA ...	1,873,663	87,613	4.7	512,895	27.3	86,944	4.6	600,508	32.0	1,273,155	68.0	316,809	16.9

Notes.—(*a*) Area out-of-tapping on estates which have partly ceased tapping refers to areas definitely being rested and excludes areas on any tapping round.

(*b*) The acreage shown in column (7) is included in columns (3) and (5).

(*c*) Areas of tappable rubber rested under rotational systems are not considered as out-of-tapping and therefore columns (11) and (12) include columns (13) and (14) respectively.

(*d*) Registered companies only.

(*e*) Figures for the quarter ending 31st March, 1939.

MALAYAN RUBBER STATISTICS Table I.

ACREAGE, STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF MAY, 1939, IN DRY TONS.

State or Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month			Consumption 3	
								during the month		January to May 1939		during the month		January to May 1939						
	Ports	Dealers	Estates of 100 acres and over	during the month	Jan. to May 1939	during the month	Jan. to May 1939	Foreign	From Malay States & Labuan	Foreign	From Malay States & Labuan	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over	during the month	Jan. to May 1939
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
MALAY STATES :—																				
Federated Malay States ...	...	5,309	25,261	9,487	46,545	2,643	19,385	Nil	Nil	Nil	Nil	10,280	3,017	55,581	12,514	...	4,200	25,187	16	79
Johore ...	...	2,367	9,696	4,184	20,936	2,341	12,922	Nil	65	Nil	202	2,476	4,883	12,804	22,145	...	1,651	9,643	...	...
Kedah ...	...	299	5,403	2,242	11,381	579	3,423	Nil	Nil	Nil	Nil	1,418	1,528	6,985	8,276	...	169	5,408	...	...
Perlis ...	...	24	25	6	35	17	99	Nil	Nil	Nil	Nil	Nil	36	Nil	141	...	12	24	...	...
Kelantan ...	...	649	500	316	1,428	734	2,962	Nil	Nil	Nil	Nil	256	381	1,453	2,463	...	1,062	500	...	...
Trengganu ...	...	47	285	146	632	171	1,049	Nil	Nil	Nil	Nil	Nil	294	Nil	1,666	...	18	337	...	...
Brunei ...	...	15	64	41	164	42	282	...	...	...	...	...	81	...	465	...	8	73	...	...
Total Malay States	...	8,710	41,234	16,422	81,121	6,527	40,122	Nil	65	Nil	202	14,430	10,220	76,823	47,670	...	7,120	41,172	16	79
S. SETTLEMENTS :—																				
Malacca ...	...	1,349	2,260	899	4,486	484	2,315	Nil		Nil		1,884		10,530		...	1,233	2,245	...	...
Province Wellesley	...	486	888	348	1,632	134	702	Nil		Nil		4,435		28,113		...	516	853	...	...
Penang ...	1,496	1,942	13	15	74	60	288	1,840	9,968	12,127	47,562		Nil		Nil	1,366	2,302	13	...	...
Singapore ...	3,338	15,669	280	105	489	14	203	1,0797		61,278		21,465		100,081		4,936	12,270	263	30	135
Labuan ...	...	18	Nil	Nil	Nil	13	46	60		261		Nil		Nil		...	19	Nil	...	...
Total Straits Settlements ...	4,834	19,464	3,441	1,367	6,681	705	3,554	12,697	9,968	73,566	47,562	27,784	Nil	138,724	Nil	6,302	16,340	3,374	30	135
Total Malaya ...	4,834	28,174	44,675	17,789	87,802	7,232	43,676	12,697	10,033	73,666	47,764	42,214	10,220	215,547	47,670	6,302	23,460	44,546	46	214

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Kedah
22	23	24	25	26	27	28
DRY RUBBER	3,597	11,990	2,221	1,550	1,381	83
WET RUBBER	603	280	81	226	270	86
TOTAL ...	4,200	12,270	230.2	1,776	1,651	169

TABLE III
FOREIGN EXPORTS

PORTS	For month	Jan. to May 1939
29	30	31
Singapore ...	30,723	149,951
Penang ...	7,472	44,853
Port Swettenham.	4,019	20,233
Malacca ...	Nil	510
MALAYA ...	42,214	215,547

TABLE IV
DOMESTIC EXPORTS 4

AREA	For month	Jan. to May 1939
32	33	34
Malay States ...	24,572	124,259
Straits Settlements	2,101	10,239
MALAYA ...	26,673	134,498

Notes:—

1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained
2. The production of estates of less than 100 acres is estimated from the formula : Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [20] − [2] − [3] − [4] − [5] − [9] − [10]. For the Straits Settlements the production of estates of less than 100 acres is represented by sales or exports as shown by cess paid.
3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15% wet sheet, 25% scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.
4. Columns (33) and (34) represent exports of rubber subject to regulation which, for Singapore and Penang Islands are represented by sales or exports as shown by cess paid.
5. All statements are brought up to date monthly, and any inaccuracies that may be disclosed are corrected in the totals; the latest publication therefore, is always the most reliable.
6. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S and F.M.S., at Singapore on 23rd June, 1939

Locality.	Air Temperature in degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine.		
	Means of			Absolute Extremes						Total.		Most in a day.	Number of days.					Total.	Daily Mean.	Per cent.
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot	At 4 feet			Amt.	Precipitation .01 in or more	Precipitation, .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more			
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						hrs.	hrs.	
Railway Hill, Kuala Lumpur, Selangor ...	91.0	73.1	82.1	94	71	83	76	84.6	85.3	7.17	182.1	1.89	13	11	3	4	3	209.50	6.76	55
Bukit Jeram, Selangor ...	89.5	73.3	81.4	93	71	84	76	85.7	87.5	7.95	201.9	2.42	10	10	—	—	3	245.30	7.91	64
Sitiawan, Perak ...	89.7	73.8	81.7	93	71	79	76	84.4	84.4	12.42	315.5	5.28	9	8	—	—	—	228.55	7.37	60
Ipoh Aerodrome, Perak ...	90.9	73.2	82.1	94	70	83	76	84.5	85.0	5.22	132.6	1.86	12	9	3	—	—	206.75	6.67	55
Temerloh, Pahang ...	90.5	73.3	81.9	94	71	84	77	86.2	86.8	6.29	159.8	1.65	14	12	4	6	1	197.25	6.36	52
Kuala Lipis, Pahang ...	90.0	71.7	80.9	94	69	84	74	84.3	85.0	7.26	184.4	3.02	12	11	5	28	1	180.80	5.83	47
Kuala Pahang, Pahang ...	87.3	74.2	80.7	89	72	82	77	85.2	86.8	10.74	272.8	2.72	18	12	—	—	—	215.15	6.94	56
Kallang Aerodrome, S'pore ...	86.9	76.8	81.9	89	74	84	81	83.3	84.0	2.33	51.6	0.72	11	8	2	—	1	200.50	6.47	53
Bayan Lepas Aerodrome Penang ...	87.5	74.5	81.0	91	72	82	78	84.3	85.2	15.17	385.3	6.53	19	15	4	—	1	178.30	5.75	47
Malacca Town, Malacca ...	85.8	74.2	80.0	89	72	81	77	84.3	85.3	8.80	223.5	4.58	14	10	3	—	1	209.60	6.76	55
Kluang, Johore ...	89.1	72.0	80.5	92	70	85	74	82.6	83.1	12.04	305.8	3.03	11	9	7	7	—	193.60	6.25	51
Mersing, Johore ...	88.4	72.3	80.3	91	70	84	74	83.6	83.0	7.13	181.1	1.39	16	15	7	—	2	232.75	7.51	61
Alor Star, Kedah ...	87.3	74.4	80.9	91	73	82	77	85.6	86.1	11.53	292.9	3.25	21	20	3	—	1	206.45	6.66	54
Kota Bahru, Kelantan ...	89.7	74.0	81.9	92	71	87	77	85.1	84.9	9.43	239.5	2.22	16	13	4	—	2	217.90	7.03	57
Kuala Trengganu, Trengganu	89.0	73.2	81.1	92	68	85	75	84.4	85.9	7.26	184.4	1.72	10	10	9		2	217.75	7.02	57
Labuan ...	87.0	76.9	81.9	90	73	83	80	84.9	86.8	11.22	285.0	2.58	19	19	3	—	1	218.80	7.06	57
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft.	74.3	63.5	68.9	78	60	68	65	72.1	72.5	7.02	178.3	1.53	20	16	2	8	—	156.40	5.05	41
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	72.9	58.0	65.5	77	52	69	62	70.5	69.8	7.68	195.1	2.03	19	17	2	3	—	152.55	4.92	40
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	72.3	60.2	66.3	77	58	67	62	*	*	8.06	204.7	2.17	19	17	—	—	4	164.65	5.31	43

* Not recorded.

Compiled from Returns supplied by the Meteorological Branch, Malaya.